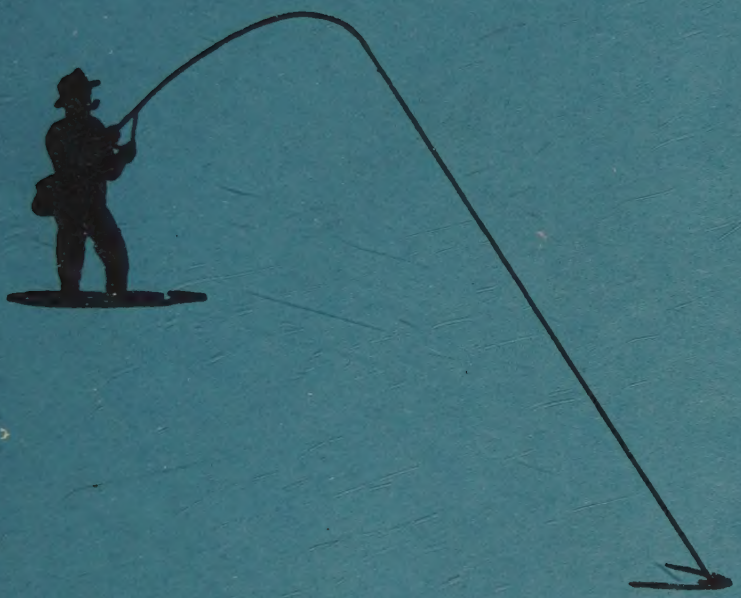
U. S. F. W. S.
PERIODICAL
4(4)

LIBRARY
FEB 20 1961
FISH & WILDLIFE SERVICE

4(4)

Sport Fishery Abstracts



Vol. 4 No. 4
Abstracts 2715 - 2929
October 1959

DEPARTMENT OF THE INTERIOR

Fred A. Seaton, *Secretary*

U. S. FISH AND WILDLIFE SERVICE

BUREAU OF SPORT FISHERIES AND WILDLIFE

Daniel H. Janzen, *Director*

The printing of this publication

was approved by the Director of

the Bureau of the Budget

February 24, 1958

Washington 25, D. C.

Sport Fishery Abstracts

An abstracting service for fishery research and management

Vol. 4, No. 4 Abstracts 2715-2929 October 1959

Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of papers on limnology, ecology, natural history and other fields of specialization will be included when the subject has application to the conservation of sport fish and the restoration of sport fishing.

One volume consisting of not more than four numbers will be issued each year. Each number contains separate Author and Subject indexes, with the final number of each volume containing cumulative indexes.

The last number of each volume contains a list of publications screened for appropriate material. Suggestions for improving the usefulness and coverage of Sport Fishery Abstracts are solicited.

The Bureau of Sport Fisheries and Wildlife of the U. S. Fish and Wildlife Service assumes no responsibility for the accuracy of material from outside sources, and can only supply copies of articles written and published by the U. S. Fish and Wildlife Service. Requests for other articles should be sent to the author or publisher.

Prepared in the Branch of Federal Aid
S. E. Jorgensen, Chief
Donald F. LaPointe, Editor
Geneva T. Thompson, Asst. Editor

2715. Gordon, Malcolm S. 1959. IONIC REGULATION IN THE BROWN TROUT. (SALMO TRUTTA L.) The Journal of Experimental Biology, Vol. 36, No. 2, pp. 227-252.

The osmotic and ionic regulatory abilities of adults of the euryhaline brown trout have been studied in experiments roughly duplicating the stresses of migration from fresh water to the sea. Brown trout will survive indefinitely in full sea water if acclimatized to it at rates inversely related to the temperature.

Blood serum samples have been analysed for Na, K, Cl, total P and Δ; muscle samples for Na, K, Cl and total solids. Changes in the concentrations of these constituents following transfers from fresh water to 50% and 100% sea water have been studied. Transfers were made throughout the year and at temperatures of 10°C. and 20°C.

Following transfers to 50% sea water at 20°C. blood concentrations rose significantly above fresh-water levels, but returned very nearly to these levels after about a week. Transfer from 50% sea water to 100% sea water at 20°C. caused the same sequence of changes. Transfer to 100% sea water at 20°C, was fatal, and associated with very high serum concentrations. Many fish survived transfer to 100% sea water at 10°C., however, and showed evidence of internal concentrations returning to fresh-water levels after 10 days. The brown trout is strongly homoiosmotic on a long-term basis.

Both survival and regulatory ability were lower during the summer. There were also seasonal variations in the blood and muscle concentrations of fish in a given state of acclimatization.

Muscle concentration changes closely paralleled blood changes. Extracellular volume remained constant, so muscle concentration changes were attributable to changes in intracellular water. The muscles did not act as storage sites for sodium and potassium. (Auth. summ.)

2716. Gordon, Malcolm S. 1959. OSMOTIC AND IONIC REGULATION IN SCOTTISH BROWN TROUT AND SEA TROUT (SALMO TRUTTA L.) The Journal of Experimental Biology, Vol. 36, No. 2, pp. 253-260.

Adult brown trout of both sea-run and fresh-water stream forms were captured in the vicinity of Aberdeen and acclimatized to full-strength sea water for periods of up to 5 months.

Blood serum samples from these fish were analysed for freezing-point depression, chloride, sodium and potassium concentrations.

The patterns of regulation of these concentrations are very nearly the same in both forms. Brown trout and sea trout at least in eastern Scotland, thus appear to be virtually identical in osmotic and ionic regulatory abilities. However, there is a possibility that there is a difference between the two forms with respect to mechanisms controlling blood acid-base balance.

The patterns of regulation shown by Scottish fish are the same as those shown by American hatchery fish treated similarly. The different populations of the species seem not to have diverged significantly from one another in this regard after many generations of more or less complete genetic isolation.

The species is strongly homoiosmotic. Internal concentrations are either unchanged or increase by less than 10% above fresh-water levels with long-term acclimatizations to half and full sea water. The brown trout is the first salmonid species known to regulate so well. (Auth. summ.)

2717. Steven, D. M. 1959. STUDIES ON THE SHOALING BEHAVIOUR OF FISH. I. RESPONSES OF TWO SPECIES TO CHANGES OF ILLUMINATION AND TO OLFACTORY STIMULI. The Journal of Experimental Biology, Vol. 36, No. 2, pp. 261-280.

Hepsitia stipes and Bathystoma rimator swim in shoals (schools) during the day but disperse at night. The fish become increasingly active as illumination decreases and shoals begin to disperse when it falls below about 0.1fc. The change from day to night patterns of behaviour is progressive; there is no sudden switch from one to the other at any single level of illumination. Exploratory feeding behaviour similar to normal nocturnal activity can be induced during the daytime by olfactory stimuli. When so stimulated the average swimming speed is about twice as fast as in unactivated fish.

Aqueous extracts of mammalian tissues, of marine animals and water in which live plankton has been kept evoke exploratory feeding behaviour. Fish so stimulated attack live plankton which they can see but not reach and will pick up and sometimes swallow pieces of filter-paper which they has previously ignored. The substance in the adductor muscle of Arca zebra that excites exploratory feeding behaviour is dialysable and unaffected by boiling. It is effective in concentrations of the order of 1×10^{-9}.

Fish can detect trace amounts of many organic substances, to a few of which they respond in a way similar to exploratory feeding, though of less intensity and shorter duration than is the case with extracts of natural food substances.

Blinded Bathystoma respond to extracts of Arca muscle with a modified type of exploratory feeding behaviour and can locate the position of pieces of food.

These experiments are discussed in relation to the behaviour of fish shoals in the sea. (Auth. summ.)

2718. Alexander, R. McN. 1959. THE PHYSICAL PROPERTIES OF THE SWIMBLADDER IN INTACT CYPRINIFORMES. The Journal of Experimental Biology, Vol. 36, No. 2, pp. 315-332.

A method is described whereby certain physical properties of the swimbladder have been determined in intact, unoperated Cypriniformes. These properties are volume, excess internal pressure, extensibility, and relative sensitivity (an index of the rate of change of volume with depth).

The mean volume of the swimbladder varies in the twelve species examined from 5.8 to 9.9 ml. /100 g. body weight. In most Cyprinidae the swimbladder gases are maintained at a mean pressure

2-3 cm. Hg above that of the surrounding water at the depth to which the fish is adapted. Higher pressures occur in a few species, most notably the bream (10. 8 cm. Hg). A much lower pressure is found in Amiurus. An excess internal pressure is probably necessary to provide a taut swimbladder wall to operate Weberian ossicles. The swimbladder wall has non-linear elastic properties such that as the excess pressure in the swimbladder rises the extensibility of its wall falls. The swimbladder also shows slow-elastic properties. The significance of these properties is discussed. Excess internal pressure and low extensibility combine to limit the rate at which the volume of the swimbladder, and so the buoyancy of the fish, changes with depth. For small depth changes the swimbladder of the bream (an extreme case) changes its volume only one-quarter as much as would a free air-bubble. (Auth. summ.)

2719. Alexander, R. McN. 1959. THE DENSITIES OF CYPRINIDAE. The Journal of Experimental Biology, Vol. 36, No. 2, pp. 333-340.

The mean sinking factor of each eight species of Cypriniformes has been determined by a method involving measurement of the pressure at which anaesthetized specimens float. It was found to lie between 1001 and 1004 for all species except the gudgeon, for which it is 1008.

Roach, dace and carp have swimbladders of very different sizes. It was shown that differences in the weight and density of the skeleton and scales, and in muscle density, are important factors in determining the volume of swimbladder gas necessary for neutral buoyancy. Differences in fat content are unimportant in these fish. (Auth. summ.)

2720. Alexander, R. McN. 1959. THE PHYSICAL PROPERTIES OF THE ISOLATED SWIMBLADDER IN CYPRINIDAE. The Journal of Experimental Biology, Vol. 36, No. 2, pp. 341-346.

The anterior sac of the cyprinid swimbladder is much more extensible than the posterior sac.

The anterior sac is not significantly more extensible in length than in other directions. (Auth. summ.)

2721. Alexander, R. McN. 1959. THE PHYSICAL PROPERTIES OF THE SWIMBLADDERS OF FISH OTHER THAN CYPRINIFORMES. The Journal of Experimental Biology, Vol. 36, No. 2, pp. 347-355.

No excess internal pressure, such as has been found in the Cypriniformes, could be detected in the swimbladders of seventeen species from other orders. The swimbladder wall in these fish exercises no appreciable constraint on changes of buoyancy with depth.

Determinations of sinking factor and swim bladder volume are reported. (Auth. summ.)

2722. Chatwin, Bruce M. 1959. THE RELATIONSHIPS BETWEEN LENGTH AND WEIGHT OF YELLOWFIN TUNA (NEOTHUNNUS MACROPTERUS) AND SKIPJACK TUNA (KATSUWONUS PELAMIS) FROM THE EASTERN TROPICAL PACIFIC OCEAN. Inter-American Tropical Tuna Commission Bulletin, Vol. III, No, 7, pp. 307-352.

Relationships between logarithms of length and weight of both yellowfin and skipjack tuna differ significantly with respect to regression coefficients, or slopes, among various sampling areas. Within areas, length-weight regressions, taken by quarter of the year, and by samples within quarters, are generally similar in slopes but may sometimes differ significantly in level.

The statistical errors associated with the length-weight relationships within areas, compared with the relationship obtained by pooling all data, were examined by means of their respective estimates for error variance. In terms of antilogarithm of standard error of estimate, the values for yellowfin and skipjack tuna, for average within area regression and for total regression are: 1. 061 and 1. 062, and 1. 065 and 1. 076 for each species respectively.

For purpose of converting length-frequency samples to weight-frequency samples it is suggested that the statistics obtained from the total regressions, will adequately describe the length-weight relationships in all areas and times of the year. For other purposes, the use of separate length-weight regressions for different sampling areas may be necessary. (From auth. conclusion)

2723. Broadhead, Gordon C. 1959. MORPHOMETRIC COMPARISONS AMONG YELLOWFIN TUNA, NEOTHUNNUS MACROPTERUS, FROM THE EASTERN TROPICAL PACIFIC OCEAN. Inter-American Tropical Tuna Commission Bulletin, Vol. III, No. 8, pp. 355-391.

Measurements were taken of total length, head length, second dorsal fin length, anal fin length, and pectoral fin length from yellowfin tuna from six major fishing areas during 1955, 1956, and 1957. Regressions of the head length and fin lengths on body length were compared among the various areas by covariance analysis. For these characters, differences among replicate samples from same area were, in most cases, as great as those found when comparing samples from the various areas of the fishery.

Morphometric data, therefore, do not indicate the separation of the stocks of yellowfin tuna fished off the West Coast of the Americas into sub-population units. Indirect evidence from catch statistics and preliminary results tagging suggest that sufficient mixing of the yellowfin tuna within this area may occur to prevent the genetic isolation of population components for any long period of time, and the consequent formation of definite characteristics in the body measurements of the fish in different subareas.

The results of this study confirm previous morphometric evidence that the stocks of yellowfin tuna in the Eastern, Central and Western Pacific areas are probably distinct from each other. (From auth. summ.)

2724. Miyadi Denzaburo. SOME INFORMATION OF THE BASIC STUDIES ON MARINE BIOLOGY IN JAPAN. Contributions from the Seto Marine Biol. Laboratory, No. 306, pp. 197-203.

Being a small island country with a large population, the land resources of Japan are not sufficient to sustain its people. They live under the influence of marine climate often suffering from typhoons coming from the sea, and the traffics between foreign countries have been carried on over the sea. Under these circumstances, it is natural that Japan has many research as well as educational organizations, which concern various problems of the sea.

Among such organizations, those having close relations with marine biological investigations may be classified into three groups: 1) marine biological stations belonging to the biology departments of universities; 2) fisheries departments of universities and their sea-side laboratories, regional fisheries research laboratories belonging to the fisheries agency of the Ministry of Agriculture and Forestry, fisheries experimental stations belonging to prefectural governments, and some non-governmental institutes relating to fishery sciences; and 3) marine observatories. A list of marine laboratories is provided. (Auth. summ.)

2725. Watanabe, Nobuo. 1958. ON THE MECHANISM OF VARIATION IN WATER TEMPERATURE AND CHLORINITY OF UPPER LAYER IN THE SEAS SOUTH-WEST OFF KYUSHU AND AROUND NANSEI-SHOTO. Bulletin of Tokai Regional Fisheries Research Laboratory, No. 21, pp. 15-24. (In Japanese with English synopsis.)

On the basis of the data obtained during the oceanographic observations in the seas southwest off Kyushu and around Nansei-shoto in the summer of 1954, the author has studied the mechanism of variation in water-temperature and chlorinity of upper layer. In the discourse mathematical treatments have been given to factors controlling the mechanism such as the heat exchange between the sea and atmosphere; the precipitation and evaporation on the surface of the sea; the transportation of heat and chlorinity due to water movement as well as mixing.

In consequence, the following conclusions have been deduced. (1) Even in the seas such as the Kuroshio-area where the water flows strongly, the meteorological effect on the sea condition in unexpectedly too great to be disregarded. (2) The eddy-diffusivity estimated from both temperature and chlorinity has the value about ten times as great as the one from temperature. (3) Computation based on the data has revealed that there is a sinking area on the seas adjacent to the Tokara Islands. On both the north and south of the sinking area, upwelling areas are located with the speed of vertical water movement to be estimated about 10^{-3} cm/sec. (4) The estimated magnitudes of factors contributing to the variation of temperature and chlorinity differ greatly even in a small areas of the region under study. It can be assumed that such circumstances will also happen to occur in different seasons or years. (Auth. synopsis)

2726. Hayashi, Ichiro. 1958. PRESERVING EFFECT OF COPPER NAPHTHENATE FOR FISHING NETS. Bulletin of Tokai Regional Fisheries Research Laboratory, No. 21, pp. 39-42. (In Japanese with English Synopsis).

Preserving effects on fishing nets by copper naphthenate treatment and its combination with coal-tar coating have been examined. In the experiments, sample pieces of fishing twines that had been treated in 1% copper naphthenate bath or its modifications and submerged in the sea were taken out at intervals of time to assess the breaking strength. Of the various treatments examined, the bathing in a linseed oil emulsion of the naphthenate seems to be most effective. The preserving effect of this treatment was found in a lineal relation with the concentration of the emulsion while the quantitative increase of the emulsion did not always result in the increase of the preservative effect. (Auth. synopsis)

2727. Hayashi, Ichiro. 1958. EFFECT OF TAR ACIDS ON SYNTHETIC FIBRE FISHING TWINE. Bulletin of Tokai Regional Fisheries Research Laboratory, No. 21, pp. 43-47. (In Japanese with English Synopsis).

With view to increasing the weight of the synthetic fiber fishing twine and alleviating the abrasion wear, coal tar is proposed for dyeing the twine. However, synthetic fibers are supposed to be susceptible to effect of organic acids contained in coal tar. With this view in mind, experiments have been carried out to see how much tar acids will effect breaking strength and elongation of various synthetic fibers in comparison of cotton twines.

Findings from the experiments are: the concentration of carbonic acid usually contained in commercial coal tar did not seriously affect the physical properties of synthetic fiber twines. In a higher concentration of carbonic acid in coal tar bath heated at 20°C, breaking strength and elongation of the sample materials were not measureably affected. Treatment with creosote oil did not also change the physical properties of the sample twines. (Auth. synopsis)

2728. Hennemuth, Richard C. 1959. MORPHOMETRIC COMPARISON OF SKIPJACK FROM THE CENTRAL AND EASTERN TROPICAL PACIFIC OCEAN. Inter-American Tropical Tuna Commission Bulletin, Vol. III, No. 6, 241-304.

An investigation of the population structure of the stocks of skipjack inhabiting the Eastern Tropical Pacific fishing region, and of their relationship to the stocks of other fishing areas in the Central Pacific. The study is based on analysis of samples of morphometrical data collected from several areas within the Eastern Pacific region, and from the Hawaiian and Society-Marquesas Island fishing areas of the Central Pacific. (From auth. introduction)

2729. Bailey, Reeve M. 1959. A NEW CATOSTOMID FISH, MOXOSTOMA (THOBURNIA) ATRIPINNE, FROM THE GREEN RIVER DRAINAGE, KENTUCKY AND TENNESSEE. Occasional Papers of Michigan, No. 599,

19 pgs.

Until the recent discovery of Thoburnia hamiltoni in the Roanoke River system in Virginia, this nominal genus was thought to contain a single species, T. rhothoeca (Thoburn). That fish is characteristic of the James River drainage, Virginia, but occurs also in the headwaters of the Shenandoah and New rivers of the Potomac and Kanawha river systems in Virginia and West Virginia. It is now possible to make known a third kind of Thoburnia. Geographically, this is relict species occuring in headwaters of the Barren River drainage of the Green River system, far to the west of its relatives. Morphologically, it is a highly distinctive fish that is less notably adapted to life in mountain torrents than are the other species of Thoburnia.

2730. Swarup, H. 1959. ABNORMAL DEVELOPMENT IN THE TEMPERATURE-TREATED EGGS OF GASTEROSTEUS ACULEATUS (L.); I CLEAVAGE ABNORMALITIES. Journal of the Zoological Society of India, Vol. 10, No. 2, pp. 108-113.

Cleavage abnormalities appear when the freshly fertilized eggs of G. aculeatus are subjected to high or low temperatures. Two types of abnormalities are noticed; (I) unequal division of the blastodisc, and (II) inhibition of cleavage divisions after a start has been made. The first abnormality is due to the chromosome mosaicism which is mostly haplo-diploid. The second abnormality is due to parthenogenetic development of the eggs. (Auth. summ.)

2731. Benson, Norman G. 1959. FISH MANAGEMENT ON WOOD'S RESERVOIR. Journal of the Tennessee Academy of Science, Vol. 34, No. 3, pp. 172-189.

Wood's Reservoir, a 4,000-acre artificial lake on Elk River, was first impounded in the winter of 1952-53, and this report describes fishery investigations and management from that time through 1956.

The reservoir is eutrophic, with a maximum depth of 65 feet and a mean depth of approximately 20 feet. It was regularly lowered in the summer for mosquito control. Temperatures were usually above 80°F. during July and August. The fishes present in Wood's Reservoir were orignial species in the Elk river and those stocked from farm ponds in the watershed. Twenty-one species were present and three species, theadfin shad, yellow walleye, and white crappie were intoduced.

Harvest data was collected 1953 and in 1956. The number of fish caught per fishing trip decreased from 3.2 in 1953 1.0 in 1956, although the average size of fish increased. The decrease in number was due to fewer largemouth bass, bluegill, and yellow bullheads. Stream species such as rock bass, longear sunfish, and smallmouth bass decreased in the catch from 1953 to 1956.

The fish population was sampled by rotenone during all years. Yellow bullheads showed a downward trend. Largemouth bass reproduction was very low for several years. Hybrid bluegill X longear sunfish were abundant in the samples in 1955. White crappie and threadfin shad were becoming abundant by 1956. Bluegill were abundant in 1956, but few were large enough to enter the creel. Growth studies showed a great increase in growth rate among largemouth bass and smallmouth bass after impoundment of the reservoir. Yellow walleye and white crappie were growing rapidly during their first year.

A discussion on the management of Wood's Reservoir is presented. Reasons are given for the introduction of the threadfin shad and the yellow walleye. A potential white crappie fishery is discussed.

The large bluegill population is suggested as a possible cause of lack of natural largemouth bass recruitment. A mosquito problem developed to make DDT spraying necessary. One fish mortality was observed which could be attributed to that spraying. The future mosquito control will be handled by water level fluctuation and small scale spraying. (Auth. summ.)

2732. Bullivant, J. S. 1959. STOMACH CONTENTS OF SPAWNING QUINNAT SALMON. Nature, Vol. 184, No. 4679, July 4. page 71.

Of 43 dead king salmon examined on the spawning grounds, 3 each had eaten one young male King salmon; the lengths of which were 5.3, 6.3, and 6.9 inches. It is suggested that these three young salmon, each with hypertrophied testes, were swallowed while being chased away from the redds by the larger fish. It is further suggested, as each of the small salmon contained food, that fasting and sexual maturity are not necessarily concomitant in male king salmon.

2733. Harris, Patricia J. 1959. A STUDY OF THYROID FUNCTION IN FUNDULUS HETEROCLITUS. The Biological Bulletin, Vol. 117, No. 1, pp. 89-99.

Thyroidectomy of Fundulus heteroclitus was attempted with the use of radioactive iodine, administered in three doses of 25, 15, and 10 μC per five weeks. A screening method was developed whereby the degree of thyroidectomy could be determined by the rate of activity loss in the throat region of the fish following a tracer dose of I^{131}. Thyroidectomy was not complete, and in some cases there was considerable regeneration. However, in general, the resulting condition was one of extreme hypothyroidism, and physiological studies conducted with these fish yielded the following results;

1. There was no special effect on the fishes' ability to survive in fresh water, although there seemed to be an impairment of their ability to survive at all, in either salt or fresh water. Deaths occurring during the experiment in general involved fish with very few follicles or no thyroid tissue remaining.

2. Blood chloride titers were a function of the salinity of the medium and were not affected by lack of thyroid.

3. Hemoglobin titers and red cell counts indicated an effect of the medium, and were not influenced by lack of thyroid.

4. Hypothyroidism had no effect on growth, either in length or weight.

5. Hypothyroidism had no effect on the gonad-

osomatic index. (Auth. summ.)

2734. Sogandares-Bernal, Franklin. 1959. DIGENETIC TREMATODES OF MARINE FISHES FROM THE GULF OF PANAMA AND BIMINI, BRITISH WEST INDIES. Tulane Studies in Zoology, Vol. 7, No. 3, pp. 71-117.

This paper is based on collections of trematodes made during the summer of 1956 in the Gulf of Panama and the summer of 1957 at Bimini, British West Indies. The trematode faunas of both these regions are little known. A total of 474 specimens representing 208 species of fishes were examined. Eighty-eight species of Digenea were collected and studied. These included two new genera, 17 new species, and 29 new host records. Observations were made on the exact location of the trematodes in the digestive tract of the host. (Auth. intro.)

2735. Bardach, John E., Howard E. Winn, and David W. Menzel. 1959. THE ROLE OF THE SENSES IN THE FEEDING OF THE NOCTURNAL REEF PREDATORS GYMNOTHORAX MORINGA AND G. VICINUS. Copeia, 1959, No. 2, pp. 133-139.

Observations and activity records clearly demonstrated that the two common Atlantic moray eels Gymnothorax moringa and G. vicinus, are nocturnally active. This rhythm tends to persist for a time under uniform darkened conditions.

Experiments demonstrated that smell is used in the location of distant food. Once the food is approached, the moray touches it with its snout and taste stimuli elicit immediate grasping of the food. Tactile receptors possibly play a subsidiary role in the last response. (Auth. summ.)

2736. Robins, C. Richard, Craig Phillips, and Fanny Phillips. 1959. SOME ASPECTS OF THE BEHAVIOR OF THE BLENNIOID FISH CHAENOPSIS OCELLATA POEY. Zoologica, Vol. 44, Part 2, Nos. 2 to 5, pp. 77-83.

Behavioral observations are described for the pike blenny, Chaenopsis ocellata Poey, under aquarium conditions. The species is strongly territorial and well suited for aquarium study. Resting, threat, attack and feeding patterns are discussed. A multicolored spot in the spinous dorsal fin and the azure branchiostegal membranes play important roles in threat and attack behavior, as does the erection of the dorsal fin, gaping of the mouth and a change in respiration rate.

Some notes are provided for Chaenopsis alepido alepidota (Gilbert), a related species from the ern Pacific, but detailed comparison of the two species is not yet possible. (Auth. summ.)

2737. Fish, Marie Poland, and William H. Mowbray. 1959. THE PRODUCTION OF UNDERWATER SOUND BY OPSANUS SP., A NEW TOADFISH FROM BIMINI, BAHAMAS. Zoologica, Vol. 44, Part 2, Nos. 2 to 5, pp. 71-76.

Two general types of sound have been recognized for males of the Bimini toadfish; data are incomplete for female specimens. These sounds are sufficiently different from other Opsanus species to permit their use in making identifications, especially under field conditions, where morphological comparisons are impossible. The chief distinction evident without physical analysis, is rapid repetition of many sound pulses into a protracted burst, whereas O. tau and O. beta sound-making features impulsive single or double pulses of sound.

On the basis of these records, it is suggested that the quality and pattern of underwater sounds may in some cases be included in taxonomic descriptions as a diagnostic specific character.

Determination of several characteristic patterns in the present Opsanus recordings have indicated that a single specimen may be capable of a variety of sounds, all produced by the large and heavily muscled air bladder.

Experimental results indicate that biological underwater sound in this species is purposeful and occurs only in response to definite physical or physiological stimulation, as reported for many other fishes. The absence of the boat-whistle sounds associated with pre-spawning behavior of other Opsanus species may be due to a current scarcity of toadfish or to the late start of field observations. (Auth. concl.)

2738. Stenger, Albert H. 1959. A STUDY OF THE STRUCTURE AND DEVELOPMENT OF CERTAIN REPRODUCTIVE TISSUES OF MUGIL CEPHALUS LINNAEUS. Zoologica, Vol. 44, Part 2, Nos. 2 to 5, pp. 53-68

The germinal tissues of Mugil cephalus L. are derived from large germ cells which are found in the gonad anlage of the 20 mm. fry. The role of these cells in the formation of sperm and oocytes and their similarity to the primordial germ cells of other fishes suggests that they are primordial germ cells.

No evidence has been found to support the belief that peritoneal or other somatic cells transform into gametic elements.

Mullets exhibit a juvenile, sexually-indifferent stage.

Oocyte-like germ cells are found in varying amounts in the indifferent gonads and in the testes of mature and spent males.

The presence of oocyte-like cells in immature and mature male mullets suggests intersexuality rather than protogyny.

The evidence from this study suggests that male mullets mature sexually at a smaller size than do females. Males, it would appear, become mature at about two years of age; females first ripen during their third year. (Auth. concl.)

2739. Yashouv, A, and A. Hefetz. 1959. A KEY TO THE TILAPIA SPECIES FOUND IN POND AREAS. Bamidgeh, Volume 11, No. 2, pp. 36-42.

The three species, nilotica, galilaea, and Zillii, are differentiated.

2740. Weinreb, Eva Lurie. 1959. STUDIES ON

THE HISTOLOGY AND HISTOPATHOLOGY OF THE RAINBOW TROUT, SALMO GAIRDNERI IRIDEUS. II. EFFECTS OF INDUCED INFLAMMATION AND CORTISONE TREATMENT ON THE DIGESTIVE ORGANS. Zoologica, Vol. 44, Part 2, Nos. 2 to 5, pp. 45-52.

This study was undertaken to determine whether physiological responses to induced inflammation in a poikilothermic vertebrate such as the trout are similar to those found in common laboratory animals. Responses of the digestive tract tissues, particularly those of the stomach and intestines, were studied following chemically and physically induced inflammation. Effects of cortisone on inflammation and wound healing were also determined. The histology of the digestive organs under such experimental conditions was compared with the normal histology previously described.

Responses of digestive tract tissues were studied over a 72-hour period following turpentine injection and surgical trauma. Histological changes, characteristic of acute inflammation, were noted in the stomach, intestine and caeca one hour after injection, being most prominent in the cardiac stomach.

Increase in the number of fibroblasts and granule cells in the stomach was marked after 7 hours, followed by decrease in granule cell number at 24 hours with the appearance of "rubercles," returning to almost normal after 2 days. A cyclic activity of the granule cell is suggested.

Lesions in the intestine and caeca were less extensive; necrosis was attributed to pancreatic cyzyme digestion.

Cortisone given concurrently with turpentine resulted in a delayed response, tissue removed after 24 hours resembling that seen 7 hours after turpentine alone. Following pretreatment with cortisone no lesions were apparent.

Increased phagocytosis coincident with inflammation was demonstrated after Thorotrast and turpentine injections. Augmentation of macrophagic activity was attributed to adrenal cortical stimulation of R-E elements with stress.

Cortisone injection preceding incising of the intestine resulted in inhibition of wound healing, with less granulation tissue, fewer inflammatory cells and more extensive necrosis.

The response of blood elements in the tissues corresponds with changes noted in the circulating leukocytes. The physiological responses in the rainbow trout are similar to those reported in mammals under comparable conditions. (Auth. summ.)

2741. Ali, M. A., and W. S. Hoar. 1959. RETINAL RESPONSES OF PINK SALMON ASSOCIATED WITH ITS DOWNSTREAM MIGRATION. Nature, Vol. 184, No. 4680, pp. 106-107.

Laboratory tests support the theory that, whether pink salmon is transported or actively swims downstream, its nocturnal movement will be initiated when visual contact with its environment is reduced or impaired. This will be associated with the rather specialized behavior of rising to the surface at low intensity.

2742. Garside, E. T. and F. E. J. Fry. 1959. A POSSIBLE RELATIONSHIP BETWEEN YOLK SIZE AND DIFFERENTIATION IN TROUT EMBRYOS. Canadian Journal of Zoology, Vol. 37, No. 4, pp. 383-386.

Myomere numbers were counted in samples of reciprocal hybrids of lake and speckled trout. The fish which developed on speckled trout yolks, which are the smaller, had a lower mean myomere number. Myomere numbers of normal lake trout, speckled trout, and the F_1 hybrid (lake trout egg) were compared with myomere numbers of their respective Siamese twins. An inverse relationship between myomere number and the degree of twinning was found in speckled trout but not in the lake trout or the hybrid. Since this relationship is not evident in fish developed on larger yolks it is assumed that there is a certain critical yolk size below which it becomes limiting snd prevents the formation of the normal myomere complement. (Auth. abst.)

2743. Hoar, William S., and G. Beth Robertson. 1959. TEMPERATURE RESISTANCE OF GOLDFISH MAINTAINED UNDER CONTROLLED PHOTOPERIODS. Canadian Journal of Zoology, Vol. 37, No. 4, pp. 419-428.

Goldfish maintained under controlled photoperiods for 6 weeks or longer were relatively more resistant to a sudden elevation in temperature when the daily photoperiods had been long (16 hours) and relatively more resistant to sudden chilling when they had been short (8 hours). The magnitude of the effect varied with the season. Thyroid activity was slightly greater in fish maintained under the shorter photoperiods. The longer photoperiods stimulated more rapid growth ovaries during late winter and early spring. The endocrine system is considered a link in the chain of events regulating seasonal variations in resistance to sudden temperature change. (Auth. abst.)

2744. Houston, Arthur Hillier. 1959. LOCOMOTOR PERFORMANCE OF CHUM SALMON FRY (ONCORHYNCHUS KETA) DURING OSMOREGULATORY ADAPTATION TO SEA WATER. Canadian Journal of Zoology, Vol. 37, No. 4, pp. 591-605.

Transfer into sea water produced an immediate and marked depression of the cruising speed of chum salmon fry. Despite considerable recovery from this initial effect the fish exhibited a continuing slight depression of cruising speed over the entire experimental period (80 hours). Variations in total body levels of chloride and water were significantly correlated with changes in cruising speed, suggesting that variations in activity might be related to the process of osmoregulatory adaptation to sea water. Possible mechanisms underlying this effect have been discussed. (Auth. abst.)

2745. Chapman, Douglas G. 1959. THE ANALYSIS OF A CATCH CURVE. Biometrics, Vol. 15, No. 3, pg. 489.

The age distribution of a random sample from a

stable animal population provides information on the mortality rates of the population. In this paper the maximum likelihood estimates of the mortality rate and its asymtotic variance are given. The assumptions underlying the more usual regression estimate are studied critically. If the population is not stable and in particular if the recruitment varies over time, the estimates of mortality rates are biased. The nature of this bias is studied for various possible situations. Finally, it is shown that the estimation of the components of mortality due to natural causes and exploitation by a regression of catch per unit of effort on effort can also be applied to a single catch curve. The procedure is dependent on the assumption of constant recruitment but otherwise has several advantages over the standard application of the procedure to a series of catch per unit of effort data. (Auth. abst.)

2746. Gibbs, Robert H. Jr., and Bruce B. Collette. 1959. ON THE IDENTIFICATION, DISTRIBUTION, AND BIOLOGY OF THE DOLPHINS, CORYPHAENA HIPPURUS AND C. EQUISELIS'. Bulletin of Marine Science of the Gulf and Caribbean, Vol. 9, No. 2, pp. 118-152.

Coryphaena hippurus, the common dolphin, and C. equiselis, the pompano dolphin, have been studied. The specific name equiselis is considered valid, as opposed to the amended form, equisetis. The two species differ markedly in numbers of dorsal and anal rays and lateral-line scales, in morphometric characters which reflect depth, in relative heights of dorsal and anal fins, in the shape of the tooth patch on the tongue, and in the color pattern and head spination of the young. Weights of males and females are similar below about 950 mm, after which males appear heavier. Both species are probably cosmopolitan in warm seas. C. hippurus is most often caught in waters over 70°F. Adults of C. equiselis are seldom caught and are probably more pelagic and more tropical. C. hippurus breeds in summer in the Gulf Stream, earlier in the Caribbean young C. hippurus are, paradoxically, less abundant than those of C. equiselis, particularly in the gulf of Mexico and Florida Current. The sex ratio of C. hippurus is 50:50 in the Gulf Stream, but females apparently predominate in Carribbean sport catches. Stomach analyses show fishes to be the most abundant item in the diet of C. hippurus, with no evidence of selectivity. There is some indication that feeding is inhibited at night. (Auth. abst.)

2747. De Kock, L. L., and S. Symmons, 1959. A LIGAMENT IN THE DORSAL AORTA OF CERTAIN FISHES. Nature, Vol. 184, No. 4681, p. 194.

Two longitudinal vertebral ligaments occur in most fishes. Little appears to be known of a third longitudinally placed elastic fibrous ligament lying between the centra and the dorsal aorta, which is firmly attached to the basioccipitals in front, and passes to the end of the tail through the haemal arches. Its presence has been recorded in only a few fishes, sturgeon, salmon and trout, and herring If, as is theorized, this ligament has in fact a role in the circulatory mechanism, its presence in additional groups of fishes should be of considerable interest.

2748. Mount, Donald I. 1959. SPAWNING BEHAVIOR OF THE BLUEBREAST DARTER, ETHEOSTOMA CAMURUM (COPE), Copeia, 1959, No. 3, October 9, pp. 240-244.

In the stream adult bluebreasts were found during the spawning season only on riffles containing large boulders (12 to 20 inches in diameter) with some fine gravel around or under them. This fact, when considered in light of the observations made in the laboratory, indicates that spawning in the stream takes place around or under large boulders located near the crests of riffles, and that the eggs are deposited in the fine gravel found near these boulders. Most of the spawning takes place from May 15th to June 10th in central Ohio, when water temperatures range between 21° to 24° C. (Auth. summ.)

2749. Zhuravel', P. A. 1959. A MYSIS THAT IS NEW FOR THE DNEPR SYSTEM - HEMIMYSIS ANOMALA SARS - IN THE DNEPR RESERVOIR (NOVAYA DLYA SISTEMY DNEPRA MIZIDA s HEMIMYSIS ANOMALA SARS V DNEPROVSKOM VODOKHRANILISHCHE) Dopovidi Akademii nauk Ukrains'koi RSR, Nr 1, pp. 85-87 (USSR)

A Hemimysis anomala Sars was revealed in the lower, near the dam portion of the Dnepr reservoir (Lenin lake) in September 1958 at depths of 5-30 m and more. It was brought into the reservoir in 1957, together with the estuary fauna caught in the upper portion of the Dnepr estuary, and the lower (estuary-like) Ingulets river, to stock the new reservoir. The mysis now behaves like a deep-water species. The dragging of the bottom was performed by the author, and a group of workers of the Dnepropetrovsk Institute of Hydrobiology, which included V. L. Bulakh, P. Ya. Lavrinenko. The Hemimysis anomala was transplanted to beeed in the Dnepr estuary and Dnepr reservoir areas, to provide forage for the fish. (Auth. abst.)

2750. Schwartz, Frank J., and John Norvell. 1958. FOOD, GROWTH AND SEXUAL DIMORPHISM OF THE REDSIDE DACE, CLINOSTOMUS ELONGATUS (KIRTLAND), IN LINESVILLE CREEK, CRAWFORD COUNTY, PENNSYLVANIA' Contribution No. 115, Maryland Department of Research and Education, Solomons, Maryland. The Ohio Journal of Science, Vol. 58, No. 5, p. 311.

Two hundred and thirty-four specimens of Clinostomus elongatus from Linesville Creek, Crawford County, Pennsylvania, were sampled for studies of food, growth and sexual dimorphism during 1955.

The food of the redside dace consisted of 76.9 percent terrestrial insects. Seventeen percent of the total volume was composed of bottom forms such as Diptera pupae, Ephemeroptera and Odonata. Only a little over four percent of the food consisted of groups other than insects such as arachnids, hydracarina and plants.

Diptera formed the greatest quantity, 27.7 percent volume, and the most frequent food item in the diet. Other orders, such as Coleoptera and Hymenoptera contributed the next greatest quantities as food items.

A shift in the size and quantity of food was noted from that of Diptera to Coleoptera and Hymenoptera during different months of the year and by age groups. Older fish tend to feed on larger organisms than fish one year old.

Much variation exists in the standard and head lengths of redside dace; however, a general growth-increment decrease of 50 percent annually was noted.

Annuli are laid down by October 25 while circuli formation is evident as early as March 4.

The annulus is a clear zone best seen in the anterior field of the scale and delineated on the sides by successive circulae running together to form one prominent circulae within the posterior field.

Pectoral fin lengths can be used with certainty at all times of the year as a means of distinguishing between sexes. Male fins for all specimens and year groups are longer than female fins. A general relationship of 1.15 to 1.19 (males) and 1.36 to 1.41 (females) exists for the pectoral in head length ratio of fish 2 to 4 years old.

The pectoral fin in standard length ratio may be used cautiously as a recording means of distinguishing between sexes.

The use of genital papilla shape and length should be used sparingly as only during the breeding season are they distinct. Throughout the remainder of the year their shapes may be rigid or tubular in either sex. (Auth. summ.)

2751. Hane, S., and O. H. Robertson. 1959. CHANGES IN PLASMA 17-HYDROXYCORTICOSTEROIDS ACCOMPANYING SEXUAL MATURATION AND SPAWNING OF THE PACIFIC SALMON (ONCORHYNCHUS TSCHAWYTSCHA) AND RAINBOW TROUT (SALMO GAIRDNERII). Proceedings of the National Academy of Sciences of the United States of America, Vol. 45, No. 6, p. 886.

Plasma 17-hydroxycorticosteroids have been determined in king salmon at successive stages of sexual development from complete immaturity in the sea to full maturity on the spawning grounds. Plasma samples taken at two points on the spawning migration showed a marked rise in 17-OHCS concentration in both males and females of 4 to 5 times the normal value at sea of 11.8 μg /100 ml. At spawning the females showed a further rise to a mean of 79 μg /100 ml, while the concentration in the males fell to 31 μg /100 ml. Chromatographic studies of the plasma of sexually mature salmon revealed the presence of hydrocortisone and cortisone, predominantly the former. Absorption spectra of the sulfuric acid chromogens and Rf values gave further confirmation of the nature of these two corticoids. No other corticosteroids were detected. Concentrations of 17-OHCS in the plasma of spawning anadromous rainbow trout (steel-head) averaged 23 μg /100 ml for the males and 35 μg /100 ml for the females. Chromatographic analysis demonstrated the same corticoids as in the salmon. In sexually mature nonmigratory male rainbow trout (hatchery reared) a concentration of only 10.0 μg /100 ml was present.

The realationship of the plasma corticoids to the degree of adrenal hyperplasia is discussed. (Auth. summ.)

2752. LesVeaux, John F. 1959. SUMMARY REPORT OF SURVEY TO EVALUATE THE NEED FOR SPECIFIC FISH TOXICANTS IN SPORT FISHING WATERS. Prog. Fish-Cult, Vol. 21, No. 3, pp. 99-110.

A resume has been made of the replies received to a questionnaire mailed to each state to determine the probable potential market for specific chemicals for the control of carp and other unwanted fish. (Auth. abst.)

2753. Snieszko, S. F., C. E. Dunbar, and G. L. Bullock. 1959. RESISTANCE TO ULCER DISEASE AND FURUNCULOSIS IN EASTERN BROOK TROUT, SALVELINUS FONTINALIS. Prog. Fish-Cult, Vol. 21, No. 3, pp. 111-116.

Four strains of eastern brook trout from four different hatcheries were exposed to experimental infections with Hemophilus piscium (ulcer disease) and Aeromonas salmonicida (furunculosis). Under regular hatchery operations at the Leetown Station there were no losses due to either one of the diseases among the resistant strains of brook trout, whereas almost all of the susceptible brook trout died from ulcer disease. (Auth. abst.)

2754. Sneed, Kermit E., and H. P. Clemens. 1959. THE USE OF HUMAN CHORIONIC GONADOTROPHIN TO SPAWN WARM-WATER FISHES. Prog. Fish-Cult, Vol. 21, No. 3, pp. 117-120.

Human chorionic gonadotrophin was used to ovulate goldfish and to spawn 3 pairs of white crappie and 39 pairs of channel catfish. At first, spawning was precipitated in carefully selected female channel catfish when 1 to 7 dosages at the level of 300 to 1,000 IU per pound of body weight were injected intraperitoneally. Later it was discovered that usually 1 injection of 800 IU per pound induced spawning 16 to 87 hours after the hormone was administered at temperatures of 70° to 75°F. Five of the 39 spawns were incomplete. As human chorionic gonadotrophin is readily available under the trade name APL (and others which we have not yet tried) at drugstores throughout the country, the collection, preservation, storage, and preparation for injection of fish pituitaries are no longer necessary for induced spawning practices. (Auth. abst.)

2755. Mullan, James W. 1959. OBSERVATIONS ON THREE RECLAIMED TROUT PONDS IN MASSACHUSETTS. Prog. Fish-Cult, Vol. 21, No. 3, pp. 121-130.

A pond reclaimed in September 1950 apparently contained 900 pounds of warm-water fish, though only 820 pounds was removed. The pond was restocked in May 1951 with 3,000 fingerling and 500 yearling brook trout. Fishing was prohibited during

1951 and 1952, and more trout were stocked in 1955 and 1956. The maximum angler harvest during 1953-56 occurred in 1955 and amounted to 1,124 trout (about 400 pounds). When the pond was re-reclaimed in October 1956, illegally introduced bullheads and smelt formed 51% and 38%, respectively, of the poundage recovered.

Reclamation of a second pond in September 1952 yielded about 857 pounds of warm-water fish. After restocking and subsequent maintence stockings with fingerling rainbow and brook trout, the maximum annual angler harvest was 457 trout (about 240 pounds). Reclamation after the 1956 fishing season yielded an additional 233 brook and rainbow trout (72 pounds).

A pond that had an unscreened outlet was reclaimed in October 1951, when about 731 pounds of warm-water fish was removed. The pond was restocked in April 1952 with 3,500 brook trout (270 pounds). Fishing was prohibited during 1952 and 1953. In November 1952 the pond apparently contained 2,925 trout (651 pounds). A study in the fall of 1953 indicated the presence of only 523 trout. Opened to anglers the following spring, the pond yielded 350 to 400 trout in the first few weeks but none thereafter. (Auth. abst.)

2756. Rockwell, Julius, Jr., and Sung Pal Chur. 1959. AN UNDERWATER OBSERVATION CHAMBER. Prog. Fish-Cult, Vol. 21, No. 3, pp. 131-134.

A submersible chamber suitable for use in observing and photographing underwater life is described. Details of construction, operation, and maintenance are discussed. (Auth. abst.)

2757. Piper, Robert G., and Ken Wolf. 1959. COST OF DISEASE TREATMENT. Prog. Fish-Cult, Vol. 21, No. 3, pp. 135-137.

A table is presented for determining quickly the cost of treating fish with drugs fed at various rates when the weight of the fish treated is known. Standard treatments used with various drugs are listed, with recommended dosage, period of treatment, and approximate current cost of the drugs. As many publications on fish diseases give dosages in milligrams per kilogram of fish, several of the most common conversions of kilograms to pounds are provided. (Auth. abst.)

2758. Beall, Harvey B., and Richard W. Wahl. 1959. TRAPPING BLUEGILL SUNFISH IN WEST VIRGINIA PONDS. Prog. Fish-Cult, Vol. 21, No. 3, pp. 138-141.

Three traps--the double-funneled cylindrical trap, the standard Carlander trap, and a single-funneled cylindrical trap,-- were found to be suitable for use in farm ponds.

A baited, double-throated, cylindrical trap was the most satisfactory for selective trapping. The catch can be restricted to fish of small, intermediate, or large size, depending on the mesh size and the diameter of the throat opening. Observations indicate that 0.75-inch mesh hardware cloth and a 2.25-inch throat opening would be well suited for trapping stunted bluegill populations. Traps should be 5 feet or more in length and at least 18 inches in diameter. Cottage cheese proved to be a highly effective bait. By trapping continuously, a pond owner might expect to remove 20% to 30% of a bluegill population from a pond in 4 to 6 weeks. (Auth. abst.)

2759. Lambou, Victor W. 1959. BLOCK-OFF NET FOR TAKING FISH POPULATION SAMPLES. Prog. Fish-Cult, Vol. 21, No. 3, pp. 143-144.

The advantages of using a block-off net in taking fish population samples by rotenone poisoning are discussed. A block-off net which has been found very useful in taking fish population samples in Louisiana is described. Details of construction and cost estimates for the block-off net are given. (Auth. abst.)

2760. El-Zarka Salah El-Din. 1959. FLUCTUATIONS IN THE POPULATION OF YELLOW PERCH, PERCA FLAVESCENS (MITCHILL), IN SAGINAW BAY, LAKE HURON. U. S. Fish and Wildlife Service, Fishery Bulletin 151, Vol. 59, pp. 365-415.

The average annual commercial production of Saginaw Bay yellow perch dropped from 1,961,309 pounds in 1891-1916 to 499,948 pounds in 1917-55. Since 1938 (1939-55), the catch has exceeded 500,000 pounds in only 3 years. The small catches of 1939-55 do not reflect scarcity of yellow perch. The catch of legal-sized fish per unit-of-effort has tended to increase, but fishing intensity has decreased sharply.

This paper is written around two major themes: Comparison of perch collected in 1929-30 with speimens collected in 1943-55, as to growth rate, age composition, size distribution, length-weight relation, and sex ratio; description and inquiry into the causes of fluctuations in the strength of the year classes of 1939-52, and of the growth rate during 1942-54.

The growth in length and weight of Saginaw Bay yellow perch in 1943-55 was the slowest yet reported from any Great Lakes waters. The decrease in growth rate in Saginaw Bay was believed to have resulted from a more than sevenfold increase in the population density. A "space factor" rather than competition for food may account for the decline in growth rate. Fish of the 1943-55 samples gave no evidence of a scarcity of food; on the contrary, they were heavier for their length than fish caught in 1929-30.

The weight of yellow perch in the 1943-55 samples increased as the 3.262 power of the length. Seasonal changes in the length-weight relation were small. females lost 12.3 percent of their weight at spawning.

Age determination and growth calculation were based on the scales of 4,285 fish, 3,407 of them collected during the spawning seasons of 1943-55 and the remainder at other seasons in 1955. The average age of fish in impounding-net samples collected in the spring increased between 1929-30 (3.8 years) and 1943-55 (4.3 years), and growth declined sharply. Saginaw Bay yellow perch of the 1929-30 samples reached legal length (8½ inches) in 3 years but those taken in 1943-55 required more than 5 years to attain the same size. At the same time the modal length dropped from 8.5-8.9 to 6.5-6.9 inches and the percentage of legal-sized fish from 74 to 11 percent. In both periods, the females averaged larger than the males and grew

more rapidly.

Males were relatively more plentiful in 1943-55 (62 percent) than in 1929-30 (25 percent). The percentage of males decreased with increase of age in 1929-30 but increased in 1943-55. Both males and females attained sexual maturity at a small size nearly all males were mature at 5.0-7.5 inches; 80 percent of females at 7.0-7.4 inches).

The strongest year classes were those of 1939 and 1952. The weakest were those of 1941 and 1945. Year-class strength was correlated significantly with production 4, 5, and 6 years later, but it was not correlated with the abundance of legal-sized fish in the year of hatching or with temperature, precipitation, water level, and turbidity.

The annual fluctuation of growth (length) in the first and in later years of life were dissimilar. First-year growth was poorest in 1942 but tended strongly to improve in subsequent years. First-year growth was correlated negatively with turbidity in June but was not correlated with year-class strength or other factors investigated. Fluctuations of growth in later years of life were largely without trend. Growth in these years was not correlated with the abundance of legal-sized fish, temperature, precipitation, or turbidity, but varied inversely with the water level for May to October. (Auth. abst.)

2761. Berry, Frederick H. 1959. YOUNG JACK CREVALLES (CARANX SPECIES) OFF THE SOUTHEASTERN ATLANTIC COAST OF THE UNITED STATES. U. S. Fish and Wildlife Service Fishery Bulletin 152, Vol. 59, pp. 417-535.

The young of five species of jack crevalles (Caranx) commonly occur off the Atlantic coast of the United States: Caranx crysos, C. ruber, C. bartholomaei, C. latus, and C. hippos. Morphometric, meristic, and morphological characters, and serial illustrations are presented for each of these species from the smallest larval or early juvenile sizes available into the better-known juvenile and adult stages. Development of certain body parts is defined and discussed, and comparisons are made for the species. The smallest available specimens of C. dentex and C. lugubris-species which occur in the Western Atlantic, but have not been reliably reported from inshore waters of the United States-are briefly compared with the five common species. Nomenclatorial problems are discussed; several identification and distribution records are corrected; and a key to the seven species is given.

Apparently the five common species have an offshore larval existence. Off the southeastern Atlantic coast of the United States the larval stage occurs in association with the offshore waters of the Gulf Stream. C. latus and C. hippos lose their preopercular spines (a larval character persisting into the juvenile stage) at about 20 mm standard length-at a smaller body size than occurs in the other three common species-and they tend to migrate inshore at about this size. C. crysos, the relatively most-abundant young Caranx in this area, apparently does not migrate inshore before its late juvenile stage; C. ruber has an apparent tendency to remain offshore. As late juveniles or adults, all these species may return to more southern areas.

The following suppositions are made regarding spawning of the five common species: Spawning tends to occur in offshore waters, at least partially in association with major current systems, and extends from about February into September. C. bartholomaei probably spawns off the southeastern Atlantic coast of the United States. and the other four common species do spawn there; but the major spawning areas for these species are to the south of this area.

The time and place of spawning and the larval and early juvenile forms are unknown for C. dentex and C. lugubris. Their juvenile and adult habitats are apparently in offshore waters and in association with offshore islands.

The smallest, definitely identified specimens available for study were, in standard length. C. crysos, 5.4 mm.; C. ruber, 12.4 mm.; C. bartholomaei, 8.1 mm.; C. latus, 16.1 mm.; C. hippos, 15.3 mm.; C. dentex, 87 mm.; and C. lugubris, 242 mm. A series of specimens, 5.4 to 8.3 mm., identified only as Caranx sp. ("latus and/or hippos") includes either one or both of these species.

The affinity of Hemicaranx fasciatus (Cuvier) and Uraspis heidi Fowler to the genus Caranx is briefly discussed. (Auth. abst.)

2762. Miller, Rudolph J. 1959. A REVIEW OF THE SEABASSES OF THE GENUS CENTROPRISTES (SERRANIDAE) Tulane Studies in Zoology, Vol. 7, No. 2, pp. 35-68.

Three species of Centropristes (striatus, philadelphicus and ocyurus) are recognized.

Gulf and Atlantic populations of these have been compared. The absence of intraspecific differentiation in ocyurus is probably due to the lack of isolation. Certain constant, but minor, differences were found in philadelphicus which were judged to represent a low degree of divergence, and the populations were designated as races. The amount of overlap in all characters of melanus and striatus was judged to be more representative of the subspecies level of differentiation than the species level. They were reduced, therefore, to subspecies, with Gulf forms designated C. striatus (Linnaeus).

Food habits were found to be similar in all forms with fish and crustaceans forming the major staples in the diet.

Spawning occurs from early to late spring in all species. (Auth. summ.)

2763. Breeder, C. M., Jr. 1959. STUDIES ON SOCIAL GROUPINGS IN FISHES. Bulletin of the American Museum of Natural History, Vol. 117: Article 6, pp. 397-481.

This monograph is a contribution to the understanding of the manner in which, and the reasons why, certain fishes group themselves into masses, generally referred to as schools. It includes studies on, and discussions of, all other forms of social organization known to occur in fish. All studies and considerations are integrated under four principal head-

ings: Definitions and Explorations, Special Forms of Social Groupings, Special Environmental Influences on Fish Groupings and Structural Nature of Fish Groups.

2764. Hunn, Joseph B. 1959. THE CHEMISTRY OF FISH BLOOD, A BIBLIOGRAPHY. U. S. Army Chemical Warfare Laboratories Special Publication 2-22, Project No.: 4-08-02-023, subproject No.:4-08-02-023-01, pp. 5-22.

This bibliography attempts to bring together most of the important papers on piscine blood chemistry.

2765. Gehringer, Jack W. 1959. EARLY DEVELOPMENT AND METAMORPHOSIS OF THE TEN-POUNDER (ELOPS SAURUS LINNAEUS) U. S. Fish and Wildlife Service Fishery Bulletin 155, Vol. 59, pp. 619-647.

Leptocephalid forms of the ten-pounder, Elops saurus Linnaeus, 5.1 to 31.3 mm. in standard length, were identified from plankton samples taken in waters off the south Atlantic coast of the United States during May, October, and November, 1953. These forms represent a larval stage heretofore undescribed. A developmental series was compiled from the plankton specimens and material obtained by seine in beach and marsh waters in Georgia, representing the following periods or stages of development: larval (leptocephalus, early metamorphic, mid-metamorphic, and late metamorphic), juvenile, and adult. The series is illustrated and described; and changes in form are discussed, in particular the shifting of the dorsal and anal fins anteriorly during metamorphosis. Several early metamorphic larvae, reared through metamorphosis in the laboratory, shrank in length from 35 mm. to about 20 mm. in 17-27 days

It is suggested that leptocephali occupy an offshore habitat and move into beach and marsh waters when about 40-45 mm. long. The shrinking period (early metamorphic) is spent in beach and marsh waters, and ends at about 25 mm. The mid-metamorphic period (shrinking from 25 mm. down to 18-20 mm. and subsequent length increase to 25 mm.) is spent in inshore waters. The late metamorphic period ends, and the juvenile stage begins, at about 50-60 mm., when all fins have full complements of rays, scales are present, the lateral line is formed, axillary scales are present on paired fins, and subsequent developments are principally changes in body proportions. This period is also spent in inshore waters.

The occurrence of leptocephali in offshore plankton samples indicates offshore spawning. No leptocephali have been reported from inshore waters. The length of time spent in the leptocephalid period is unknown. The presence of "shrinking" larvae in beach and marsh waters in Georgia from March to October suggests a prolonged spawning season. (Auth. abst.)

2766. Wigley, Roland L. 1959. LIFE HISTORY OF THE SEA LAMPREY OF CAYUGA LAKE, NEW YORK. U. S. Fish and Wildlife Service Fishery Bulletin 154, Vol. 59, pp. 561-617.

A life history study of the sea lamprey, Petromyzon marinus Linnaeus, in Cayuga Lake, N. Y., was conducted during 1950, 1951, and 1952. One of the major objectives was to obtain biological data concerning this endemic stock of sea lampreys for comparison with the newly established stocks in the Great Lakes.

Sexually mature sea lampreys captured on their spawning migration in Cayuga Inlet were the basis of much of this study. Such items as meristic counts, body proportions, body color, sex ratios, lengths and weights, fecundity, rate of upstream travel, effect of dams in retarding upstream movement, nesting habits, parasites, predators, estimates of abundance, and morphological changes were based on mature upstream migrants. Sea lampreys were procured by weir and trap operations and captured by hand. Tagging and marking programs each spring made it possible to determine movements and morphological changes of individual lampreys, in addition to estimating the number of upstream migrants.

Growth of parasitic-phase sea lampreys was estimated from measurements of specimens captured in Cayuga Inlet and Cayuga Lake proper.

The incubation period of lamprey eggs and the habits of ammocoetes and transforming lampreys were ascertained from specimens kept in hatchery troughs and raceways. Length-frequency and weight-frequency distributions, together with the length-weight regression, of ammocoetes from Cayuga Inlet were utilized for estimating the duration of their larval life.

Lake trout, Salvelinus n. namaycush (Walbaum), from Cayuga Lake and Seneca Lake were the subject of an inquiry into the effects of sea lamprey attacks. Incidence of sea lamprey attacks on the white sucker, Catostomus c. commersoni (Lacepede), was investigated.

Three methods are suggested for reducing the number of sea lampreys in Cayuga Lake. (Auth. abst.)

2767. Lennon, Robert E., and Phillip S. Parker. 1959. RECLAMATION OF INDIAN AND ABRAMS CREEKS IN GREAT SMOKY MOUNTAINS NATIONAL PARK. U. S. Fish and Wildlife Service, Special scientific report: fisheries. No. 306, pp. 1-22.

A complete program of stream reclamation was developed and applied on Indian and Abrams creeks in Great Smoky Mountains National Park. A salt-resistivity technique was used to estimate the dilution and velocity of a toxicant in running water. Stream-side toxicity trials on resident fishes established minimal, effective concentrations of the rotenone material. The successful removals of undesirable fish were followed by restocking with selected strains of eastern brook trout and rainbow trout. Post-reclamation observations demonstrated enhanced survival, growth, reproduction, and catch of trout. Factors which might limit the effectiveness of stream reclamation programs are discussed. (Auth. abst.)

2768. Elling, Carl H., and Howard L. Raymond. 1959. FISHWAY CAPACITY EXPERIMENT, 1956. U.S. Fish and Wildlife Service, Special Scientific Report: fisheries. No. 299, pp. 1-26.

From May 22 to September 7, 1956, eight tests were made involving the passage of varying numbers of fish through an overfall-type fish-way. The fishway, which was 6 feet long with an average depth of 6.3 feet. In the tests, from 70 to 2886 fish entered the fishway during 1-hour periods. The median passage time for fish to ascend the 6-pool fishway ranged from 12 to 35 minutes. The effect of pattern of flow and other criteria on fish passage is discussed. (Auth. abst.)

2769. Maxfield, Galen H., Kenneth L. Liscom, and Robert H. Lander. 1959. LEADING ADULT SQUAWFISH (PTYCHOCHEILUS OREGONENSIS) WITHIN AN ELECTRIC FIELD. U.S. Fish and Wildlife Service, Special scientific report: fisheries. No. 298, pp. 1-15.

The nature of squawfish predation on hatchery-reared salmon fingerlings requires an economical and practical method for continuously removing the squawfish from the areas of releases. Research has been directed toward the development of an electrical trapping device employing the principle of electrotaxis. The objectives of the study were to determine by systematic testing. (A) the optimum values of the electrical variables of (1) potential (60, 75, and 90 volts), (2) pulse frequency (2, 5, and 8 pulses per second), and (3) pulse duration (10, 20, and 30 milliseconds) for leading adult squawfish with in an electrical array; and (B) the possible significance of the direction of movement of the electrical fields. Pulse frequency was found to be the most critical variables (optimum, 2 pulses per second). Potential was significant (optimum, 60 volts), but pulse duration was not significant, at least in the range tested. The direction of the electrical fields in the laboratory in the laboratory tank was a highly significant variable. The fish showed a greater response when the electrical fields moved toward the north end of the laboratory tank than toward the south. The reason for this reaction was not determined. (Auth. abst.)

2770. Hanavan, Mitchell G., and George K. Tanonaka. 1959. EXPERIMENTAL FISHING TO DETERMINE DISTRIBUTION OF SALMON IN THE NORTH PACIFIC OCEAN AND BERING SEA. U.S. Fish and Wildlife Service, Special scientific report: fisheries. No. 302, pp. 1-22.

Five vessels were employed from May to October 1956 to study the distribution of Pacific salmons in the North Pacific Ocean and Bering Sea. The operation was designed to (1) provide samples of fish for racial identification, (2) provide evidence of seasonal movements and changes in the distribution of salmon and (3) study the ocean habitat and conditions that control the distribution, movement and survival of salmon.

The area of operation was approximately 2,000,000 square miles extending from the coast of Washington and Oregon to longitude 175° E. and from latitude 43° N. to 60° N. Within this area 195 gill net sets resulted in the capture of 7,963 salmon.

Salmon were measured aboard the vessels before freezing. Length frequencies are shown graphically by species and area and in relation to the mesh size in which the fish were captured. (Auth. abst.).

2771. Beeton, Alfred., James H. Johnson, and Stanford H. Smith. 1959. LAKE SUPERIOR LIMNOLOGICAL DATA, 1951-57. U.S. Fish and Wildlife Service Special Scientific Report: fisheries. No. 297, pp. 1-77.

Physical, chemical, and plankton data collected by the M/V Cisco (U.S. Fish and Wildlife Service) in the Lake Superior in 1952 and 1953, temperature data obtained by the M/V Williams (U.S. Lake Survey) in 1956 and 1957, and temperature recorded by thermographs during 1951-1957 are presented with limited interpretation.

Ion concentrations were low and varied little vertically, seasonally, or from area to area. A relatively high plankton abundance along the south shore from the Apostle Islands to Grand Marais, Michigan, was related to relatively high phosphorus concentrations. Much of this phosphorus may enter the lake at Duluth. If so, it must be transported by an inshore current. This movement furnishes evidence of a general counterclockwise circulation as indicated by drift cards released in 1953. (Auth. abst.)

2772. French, Robert R., and Roy J. Wahle. 1959. BIOLOGY OF CHINOOK AND BLUEBACK SALMON AND STEELHEAD IN THE WENATCHEE RIVER SYSTEM. U.S. Fish and Wildlife Service, Special scientific report: fisheries. No. 304, pp. 1-17.

The Wenatchee River contains important runs of salmon and steelhead trout. Peak yearly adult counts at Tumwater Dam for 1955-1957 were 52,000 blueback salmon, 5,200 chinook salmon, and 850 steelhead trout. Approximate peaks of migration occurred in early August for blueback, the middle of June to late July for chinook, and the end of April and late August for steelhead.

Each species and race had its characteristic spawning area. Blueback chose the tributaries of Lake Wenatchee; spring chinook, the tributaries and upper reaches of the Wenatchee River; and summer chinook spawned exclusively in the main Wenatchee River.

Downstream migrating young fish were trapped at Tumwater Dam from April to November. The peak of blueback seaward migration occurs in early May prior to the high water season. Chinook and steelhead migrate in the spring and throughout summer and Mid-October. For steelhead trout, peaks occurred in the spring and in mid-August and mid-September. The majority of blueback migrate in their second year; chinook and steelhead trout migrate in both their first and second years. (Auth. abst.)

2773. Stickney, Alden P. 1959. ECOLOGY OF THE SHEEPSCOT RIVER ESTUARY. U.S. Fish and Wildlife Service, Special scientific report: fisheries. No. 309.

Three fish and Wildlife Service and three State of Maine organizations collaborated on a comprehensive study of the ecology of the Sheepscot River estuary. This paper gives background material to introduce papers to follow by describing the physical, and biological characteristics of the estuary: Its geography, hydrography, bottom sediments, plankton composition and distribution, and higher animals and plants in the several habitat zones. Lists of the common aquatic animals and plants are included.

2774. Benson, Norman G., Oliver B. Cope, and Ross V. Bulkley. 1959. FISHERY MANAGEMENT STUDIES ON THE MADISON RIVER SYSTEM IN YELLOWSTONE NATIONAL PARK. U. S. Fish and Wildlife Service, Special Scientific Report: fisheries No. 307, pp. 1-29.

Research to appraise current fish management practices and to develop improved practices was carried on in the Yellowstone National Park portion of the Madison River system from 1953 to 1957. The physical, chemical and biological characteristics of the Firehole, Gibbon and Madison Rivers are described.

Experiments designed to test the value of fingerling and adult stocking resulted in the conclusion that fingerling stocking of brown and rainbow trout does not contribute to the fishery substantially and that adult stocking is of greatest value only in the season of stocking. Examination of scales showed that hatchery fish are readily distinguishable from wild fish. There were no differences in growth rates of wild fish in different years for different rates of stocking of hatchery fish. The brown and rainbow trout populations are not affected adversely by heavy introduction of hatchery fingerlings of each species or of adult rainbows. Brook and brown trout and whitefish are substantially underfished. (Auth. abst.)

2775. Malcolm, W. B. 1959. THE POPULATIONS OF AUSTRALIAN "SALMON", ARRIPIS TRUTTA (BLOCH AND SCHNEIDER), IN AUSTRALIAN WATERS. Australian Journal of Marine and Freshwater Research, Vol. 10, No. 1, pp. 22-29.

In Australian waters the stock of Australian "salmon", a percomorph form, is composed of two clearly defined populations. These populations are referred to as the eastern and western subspecies. The western subspecies is normally the only group found in New South Wales. The distributions of the subspecies overlap in Tasmania and Victoria.

The subspecies differ in the number of rakers on the first gill arch; the western subspecies has 25-31 rakers, the eastern subspecies 33-40. The number of gill rakers can be related to the mode of feeding as the predominant food of the western subspecies is the pilchard, Sardinops neopilchardus (Steindachner), while that of the eastern subspecies is the euphausiid, Nyctiphanes australis Sars.

Small but significant differences are evident in the number of rays in the dorsal fin, and in the number of scales around the girth. (Auth. summ.)

2776. Wright, John C. 1959. LIMNOLOGY OF CANYON FERRY RESERVOIR II. PHYTOPLANKTON STANDING CROP AND PRIMARY PRODUCTION. Limnology and Oceanography, Vol. 4, No. 3, pp. 235-245.

In general, one µg chlorophyll was equivalent to 0.5 mm^3 cell volume and 0.12 mg ash-free dry weight. The average seston content consisted of 34.5% phytoplankton, 9.8% zooplankton, and 55.7% detritus. Optimal photosynthesis per unit chlorophyll and cell volume averaged 0.39 µ mole O_2/µg chl/hr and 0.86 µ mole $O_2/mm^3/hr$, respectively. The average euphotic zone photosynthetic rate was 52% of the optimal rate. Chlorophyll content per unit volume of cells and photosynthesis per unit chlorophyll or cell volume decreased with increase in population size. Evidence was found of an interacting effect of temperature, light intensity, and phosphates on photosynthesis. An empirical method was described for estimating photosynthesis on the basis of chlorophyll content, optimal rate of photosynthesis per unit chlorophyll, extinction coefficient, and the ratio of euphotic zone photosynthesis to optimal photosynthesis. Determinations of phytoplankton respiration were made, and net euphotic zone photosynthesis was computed for various sizes of chlorophyll standing crop. It was concluded that the most frequently occurring values of chlorophyll standing crop were most likely to produce a maximum net production and to be at a steady state level. (Auth. abst.)

2777. Bryson, Reid A., and Charles R. Stearns. 1959. A MECHANISM FOR THE MIXING OF THE WATERS OF LAKE HURON AND SOUTH BAY, MANITOULIN ISLAND. Limnology and Oceanography, Vol. 4, No. 3, pp. 246-251.

The seiche in South Bay, Manitoulin Island, Ontario, consists of several components, some of which produce considerable displacements of the water which occupies the narrow entrance channel. Lateral currents displace Lake Huron water intruded into the bay by the seiche excursion, so that the return portion of the seiche cycle replaces the intruded water with Bay water, the exchange providing the mixing process. The seiche amplitude appears to be the major variable controlling the intensity of the mixing process. (Auth. abst.)

2778. McCombie, A. M. 1959. SOME RELATIONS BETWEEN AIR TEMPERATURES AND THE SURFACE WATER TEMPERATURES OF LAKES. Limnology and Oceanography, Vol. 4, No. 3, pp. 252-258.

An analysis of meteorological and hydrographic records collected at South Bay, Ontario, over the past nine years shows that when the monthly mean surface water temperatures for successive years are plotted against the monthly mean air temperatures, the general relation can be described by two linear regressions. One of these lines corresponds to the May-July period in which the temperatures rise, while the other covers the August-November period in which they fall. A quite comparable picture is also obtained for Lake Opeongo, Ontario, and Lake Mendota, Wisconsin. The latter bodies differ markedly

from South Bay in morphometry and location. Lakes Opeongo and Mendota have continental situations, whereas South Bay is enclosed in a comparatively small land mass which in turn is surrounded by very large water masses. (Auth. abst.)

2779. Rice, T. R., and Virginia M. Willis. 1959. UPTAKE, ACCUMLATION AND LOSS OF RADIOACTIVE CERIUM-144 BY MARINE PLANKTONIC ALGAE. Limnology and Oceanography, Vol. 4, No. 3, pp. 277-290.

Following the uptake of an element by marine planktonic algae is difficult if the element occurs in both the ionic and particulate states. In this investigation the radioactive cerium (Ce^{144}) occurred mostly in the particulate state when added to sea water. The rate of formation of particles containing Ce^{144} was influenced by dilution, temperature, salinity, added cerium, and the presence of a chelating compound.

A culture of Nitzschia closterium containing dividing cells removed all the Ce^{144} originally added to the medium. Different species of algae concentrated cerium from 300 to 3000 times over amounts in the medium in a period of 30 minutes. After 24 hours all 6 species tested had concentrated cerium from about 2,000 to 4,500 times. Radioactive cerium continues to be taken up for as long as three days by non-dividing Nitzschia Cells kept in the dark. The amount of cerium taken up by Nitzschia cells increased as the concentration of derium in the medium was increased. Particulate cerium became associated with the cells at a faster rate than ionic derium. The presence of a chelating compound in the medium resulted in a reduction in the uptake of De^{144} by Nitzschia cells.

Radioactive Nitzschia cells resuspended in nonactive medium lost about 25 per cent of their contained Ce^{144} in 5 hours. More Ce^{144} was lost from cells resuspended in 4 portions of nonactive medium, one after the other, than from cells remaining in the first portion of nonactive medium. A larger amount of Ce^{144} was lost from cells to medium containing a chelating compound. The greatest loss of Ce^{144} per unit of protoplasm in cells in nonactive medium was from "biological dilution." This loss amounted to $\frac{1}{2}$ of the contained activity of the cells at each division. (Auth. abst.)

2780. Hayes, F. R., and M. A. MacAulay. 1959. LAKE WATER AND SEDIMENT V. OXYGEN CONSUMED IN WATER OVER SEDIMENT CORES. Limnology and Oceanography, Vol. 4, No. 3, pp.291-298.

In defining the ability of a lake to produce a crop, one begins by taking a unit area for measurement, which is tantamount to saying that productivity is proportional to area. The productivity per unit area, P, has been stated by Hayes to be inversely related to depth, being a $\sqrt{\frac{5}{m}}$ where m is the mean depth in meters. P will have to be multiplied by a factor K which defines the crop, whether fish, plankton, etc. It is further necessary to recognize that Lakes, like farms, are sometimes on good land, sometimes on poor. This important variant may be given numerical expression as a quality index, QI, which is supposed to tell what a given lake could produce if it were considered as of standard depth 5 m. QI was previously determined for a number of lakes on the basis of fish population, factored for length of good chain. It is made to fluctuate around unity so that K is given a value of unity for fish. Finally there is a reducing correction b to be applied to certain measurements on bog lakes, which have, for example, high oxygen consumption and bacterial counts but support few fish. The bog factor may be a function of color. The foregoing considerations lead to the equation

$$P = K\sqrt{\frac{5}{m}} \times QI \times b$$

If a measurement were made on fish in a lake of 5 m depth, P would be the same as QI, all other terms having become unity.

Measurements are given of the oxygen consumption of water over mud in undisturbed profundal Jenkin cores from 16 east coast Canadian lakes. These are compared with artificial cores made by plunging a Jenkin tube into the mud of a dredge sample, and also with surface mud packed by centrifuge in bottles. All three methods gave the same values. On four lakes the field hypolimnetic deficit was compared with the laboratory tests. The mean oxygen consumptions were indistinguishable, but the field results did not arrange the lakes in the same order as laboratory tests and are judged to be related to basin dimensions rather than to productivity. Laboratory tests appear to be more accurate than field tests and of wider applicability, e. g., to unstratified lakes or bog lakes. In laboratory tests a water blank is subtracted so that consumption can be obtained for mud surface only.

For 9 lakes a regression is calculated between oxygen consumption and QI for fish. The relation is highly significant and is given as

QI = 66. 9 X oxygen consumption - 1. 31,

where the units of oxygen consumption are mg used per cm^2 mud surface per day. (Auth. abst.)

2781. Hayes, F. R., and E. H. Anthony. 1959. LAKE WATER AND SEDIMENT. VI. THE STANDING CROP OF BACTERIA IN LAKE SEDIMENTS AND ITS PLACE IN THE CLASSIFICATION OF LAKES. Limnology and Oceanography, Vol. 4, No. 3, pp. 299-315.

Procedures are given and field apparatus described for use of the millipore filter technique for lake water and sediment bacteria. Agar plate and filter procedures give the same counts using a supplemented sodium caseinate medium. Direct counts were higher than colony counts by factors from 59 to 233, with a mean of 111. Cultures made on lake sediment extract in agar were inferior to the caseinate medium in unproductive lakes, but when taken from

productive lake soils they were adequate to produce colony growth. Several hundred quadruplicate tests were studied to establish errors, which had two components: the theoretical error of a Poisson series which depends on the number of colonies on a filter, and a handling error which is ±9%. Combining the above errors with the natural variability of profundal sediment from station to station and visit to visit, and expressing the standard error of the mean as a percent, the expectations are: one visit to take one core at each of four profundal stations comprising the top two or three cm will yield, on quadruplicate plates, an error of ±130%. Hence, while a single visit may set a quite useful maximum it cannot be used to set a minimum. In the procedure adopted four field trips as above were made, by which the error was reduced to ± 36%.

Shallow cores, down to 15 cm or more, were sectioned. Surface scrapings did not yield the very high counts that others have reported. There was no significant decline in numbers down to about 5 cm, which comprises Naumann's "actual" layer. Below this a decline sets in upon entering the "historical" layer. Deep cores were taken on two lakes down to base gravel presumed 15,000 yr old. There was a decline with depth which appeared to logarithmic, although the deep counts were too close to zero to prove it.

The authors' counts, supplemented by those of Henrici and McCoy, are plotted against other measurements though to be related to productivity, namely methyl orange alkalinity, conductivity, and (in paper V of the series) oxygen consumption over mud. A good regression is observed in all clear-water lakes. However, brown-water lakes, although low in alkalinity and conductivity, have high bacteria counts. In these lakes there is a good correlation of bacterial count with water color. This provides a possible basis for stating that part of the bacterial count of any lake is to be attributed to bog. By subtraction of the bog fraction the real or useful measurement as indicative of productivity is obtained. (Auth. abst.)

2782. Hicks, Steacy D. 1959. THE PHYSICAL OCEANOGRAPHY OF NARRAGANSETT BAY. Limnology and Oceanography, Vol. 4, No. 3, pp. 316-327.

Analyses of pertinent data from various physical oceanographic programs carried out in Narragansett Bay are presented in an effort to give a useful description of tidal characteristics, temperature and salinity distributions, and the nontidal circulation. The observed tides and tidal currents are shown to be the result of a standing tidal wave with a slight progressive component and a damping coefficient of 1.6. Both temperature and salinity distributions indicate essentially homogeneous bottom water in the upper part of the Bay as contrasted with the surface layer which possesses marked progressive changes over the same area. On direct measurement and the salinity distribution seem to confirm the nontidal circulation calculations which are based on river runoff, surface nontidal currents, and cross sectional areas. Narragansett Bay appears to be an estuary in which the salt balance is maintained, under steady state conditions, by horizontal advection, vertical advection, and vertical eddy diffusion. (Auth. abst.)

2783. Pratt, David M., and Harold Berkson. 1959. TWO SOURCES OF ERROR IN THE OXYGEN LIGHT AND DARK BOTTLE METHOD. Limnology and Oceanography, Vol. 4, No. 3, pp. 328-334.

Rates of oxygen uptake per bacterial cell in dark bottles containing bacteria but no phytoplankton were applied to the bacterial population of the dark bottle in two-day light and dark bottle experiments and showed that, in the temperature range 11-21°C, bacteria were responsible for 42.5% to 62.5% of the total respiration customarily attributed to the phytoplankton. Failure to correct for bacterial respiration results in "net photosynthesis" values that are erroneously low by the same amount.

Large changes commonly occur in the bottled populations during a two-day light and dark bottle experiment: in 22 routine experiments diatoms in the light bottle increased an average of 264%/day and the total population increased 72%/day, while in the dark bottle flagellates and the total population usually decreased slightly. Respiration and net and gross photosynthesis per unit volume of water are therefore probably not the same inside and outside the bottles. The rapid multiplication of diatoms in the light bottle is due to an accelerated regeneration of nutrients by the bacteria attached to the bottle walls, as shown by comparison of diatom growth in water previously conditioned by bacteria with growth in water not so conditioned. (Auth. abst.)

2784. McConnell, William J., and William F. Sigler. 1959. CHLOROPHYLL AND PRODUCTIVITY IN A MOUNTAIN RIVER. Limnology and Oceanography, Vol. 4, No. 3, pp. 335-351.

Chlorophyll was sampled on the shallow, rocky, canyon section of Logan River-a swift, clear, calcareous mountain river in the Middle Rocky Mountains of northern Utah. Chlorophyll extractions were made by immersing entire rocks supporting algae in acetone The average quantity of chlorophyll per m^2 of bottom of the canyon section of Logan River was 0.30 grams. Downstream supplementary stations supported 3 to 4 times as much chlorophyll as the canyon section. No significant difference existed between means of chlorophyll samples in fall and late winter and between the upstream and downstream portions of the canyon section.

Annual gross primary production equal to about 1.2 kg per m^2 was estimated from the relation of chlorophyll to photosynthesis in light and dark jar experiments. A standing crop of 25 grams of dry plant biomass per m^2 was determined from the chlorophyll dry weight ratio of samples of the community. Average standing crops (dry wt.) of insects and fish were 5 and 1.6 per cent, respectively, of the producer biomass or average standing crop of algae.

Production of chlorophyll on artificial substrata (concrete rocks) showed no close relationship with

either insolation or water movement within the range of values encountered in the Logan River. (Auth. abst.)

2785. Moore, Milo E. 1957. STATE OF WASHINGTON, DEPARTMENT OF FISHERIES. 67th Annual Report, 142p. Illus. 1958; Biol. Abst., Vol. 33, No. 10, Abst. 35877, 1959.

Department of Fisheries 4015 20th Avenue West, Seattle 99, Washington. Report gives an account of the activities of the department during 1957 in the field of fish farming, stream improvement, hatcheries, research and law enforcement and contains complete statistics covering commercial fishing operations throughout the state.

2786. Yoneda, Y., and Y. Yoshida. 1957. PHYSIOLOGICAL AND ECOLOGICAL STUDIES ON RED TIDE--1. ON THE VERTICAL MIGRATION OF THE PLANKTON PRODUCING RED TIDE (1). Bull. Japanese Soc. Sci. Fish, Vol. 23, No. 7/8, pp. 405-409; Biol. Abst., Vol. 33, No. 10, Abst. 36466, 1959.

The plankton organism Sennia sp. collected from the red tide in Maizuru Bay (November, 1956) was studied. When water containing red tide was brought in laboratory, the plankton organisms found within it usually sank to the bottom of a vessel and then died. This sinking and death were kept in check by putting a proper number of pearl oysters Pteria martensii (Dunker) in the material, and adding the ordinary sea water of the bottom. Strong light, high salinity, low oxygen unsaturation, and low all pH seem to increase plankton; buoyancy; the inverse factors, fall of temperature and strong shock seem to increase sinking. Vertical plankton migration might be caused by a decrease of dissolved oxygen and an increase of light in the morning, and by the inverse states in the evening. It has often been observed that the plankton producing red tide are extraordinarily concentrated in the surface layer and form masses of discolored water along the coast or at the corners of a bay. These phenomena seem to be caused mainly by increased plankton buoyancy from the increase of light and recovery of salinity after heavy rains, the plankton which has come together at the surface is further concentrated, and wafted on the surface current by wind. (Authors)

2787. Monstad, Margit. 1958. FISHERY LITERATURE 1954. (FISKERILITTERATUR 1954.) Arsberet. Vedkommende Norges Fiskerier 1954, No. 7, pp. 1-104; Biol. Abst., Vol. 33, No. 10, Abst. 35962, 1959.

A bibliography of world literature classified under headings: Norwegian periodicals, biology, fishery and catch, processing, marketing, Fishery Directorate publications, author index. (R. P. E.)

2788. Nozawa, K., and Y. Nozawa, 1957. STUDIES ON THE PROTOPLASM OF ALGAE 111. THE CORRELATION BETWEEN SALINITY OF SEA WATER AND TOXICITY OF AMMONIUM SULFATE TO THE LAVER CELL. Bull. Japanese Soc. Sci. Fish, Vol. 23, No. 7/8, pp. 423-426; Biol. Abst., Vol. 33, No. 10, Abst. 36479, 1959.

Experiments were carried out in the range from 0 to 34‰ in chlorinity and with the concentration of 0.01-, 0.003-, and 0.001 mol of ammonium sulfate. The cell was killed in chlorinity from 0 to 4‰, considerably injured from 6 to 10‰, normal from 12 to 20‰, and again considerably injured over 22‰. Ammonium sulfate is poisonous even in low concentrations of about 0.001 mol. It was characteristic that the injury increased in water of low chlorinity between 8 and 10‰, and in that of higher chlorinity between 22 and 26‰ more than the chlorinity between 12 and 20‰, which is the similar value to the natural sea water. The adaptability of the layer to the salt water is not as flexible in lower or higher chlorinity as in natural sea water. (Authors)

2789. Taguchi, Kisaburo. 1956. A REPORT OF DRIFT-BOTTLE SURVEYS OFF KAMCHATKA, USSR IN 1940 and 1941. Bull. Japanese Soc. Sci. Fish, Vol. 22, No. 7, pp. 393-399; Biol. Abst., Vol. 33, No. 10, Abst. 36485, 1959.

Before the war salmon gill-net crews caught fish off the E. and W. coasts of Kamchatka. These fish hatched on the peninsula but grew and matured in unknown areas of the N. Pacific, and finally appeared around the Kornandorskie Islands. Drift bottles, designed to become entangled in gill-nets, were used to see what currents brought the fish in. It was determined that a westerly warm water current from the Kornandorskie region proceeds toward the Gulf of Kamchatskii perpendicular to the general coast line of the peninsula, and a cold current flows along the East coast of Kamchatka in SW direction. Migration of the salmon is wholly subject to the 2 currents in superficial layers at about 9 miles per day. Certain subsidary clock-wise currents were noted. (G. G.)

2790. Taguchi, Kisaburo. 1957. SEASONAL VARIATION OF THE GOOD FISHING AREA OF SALMON AND THE MOVEMENTS OF WATER MASSES IN THE WESTERN NORTH PACIFIC. 11. THE DISTRIBUTION AND MIGRATION OF SALMON POPULATION IN OFFSHORE WATERS. Bull. Japanese Soc. Sci. Fish, Vol. 22, No. 9, pp. 515-521; Biol. Abst., Vol. 33, No. 10, Abst. 36486, 1959.

The distribution of salmon population was observed through the catches of 339 gillnet-boats operated during the 1955 season. The fishing area and the seasonal variations of good fishing areas for each species are shown. Seasonal variation of good fishing areas in relation to the movement of water mass suggests that the migration of salmon coincide with movement of water mass even in offshore waters, but good catches of red salmon and chum salmon will be made along the boundary where the tongue of cold water from the coast of Kamchatka projects into the branch current of Kuroshio. (Auth. abst.)

2791. Gaufin, Arden R. 1959. PRODUCTION OF BOTTOM FAUNA IN THE PROVO RIVER, UTAH. Iowa State Coll. Jour. Sci., Vol. 33, No. 3, pp. 395-419; Biol. Abst., Vol. 33, No. 10, Abst. 36493, 1959.

This typical mountain stream of the Intermountain Region was studied between Sept. 15, 1946 and May 30, 1949 with productivity of invertebrate animals. Seasonal and altitudinal trends were detected in the sample were greatest from Dec. to March, and least from April to June. Increase of productivity of the stream was noted with descent from the headwaters to Utah Lake. Slight differences in chemical and physical characteristics of the water were noted. The great majority (95.2%) of the bottom fauna belonged to 5 orders of insects: Trichoptera, Ephemeroptera, Diptera, Plecoptera, and Coleoptera. The same 5 orders also comprised 94.2% of the total volume. The most abundant and widely distributed organisms were: Brachycentrus occidentalis, Pteronarcys californica, P. badia, Baetis tricaudatus, Ephemerella inermis, E. grandis, and Heterlimnius quadrimaculatus. A stream bed of large boulders or rubble, great variability in velocity, volume, and temperature, neutral or slightly acid water, and low carbonate content were correlated with low productivity at higher altitides. A stream bed of coarse gravel and silt, greater uniformity in velocity, volume, and temperature, uniformly alkaline water (pH 7.7 or above), and high carbonate content were associated with high productivity at the lower elevations. (From auth. summ.)

2792. Itazawa, Yasuo. 1957. COMPARISON OF FOUR DIFFERENT METHODS FOR THE DETERMINATION OF THE DISSOLVED OXYGEN IN THE FISH CULTURE POND WATER. Bull. Japanese Soc. Sci. Fish, Vol. 23, No. 1, pp. 27-32; Biol. Abst., Vol. 33, No. 10, Abst. 36496, 1959.

The O_2 content of water with abundant phytoplankton is undervalued by the Winkler method due to absorption of the iodine by the plankton; it is overvalued by the Miller-Sabata ferrous method due to indistinctness of the titration end point. The accuracy of the latter also decreases with increase in salinity due to precipitation of certain cations by the hydroxide of the reagent. The Winkler-Sagawara CO_2 method and Van Slyke's method are precise and accurate. (G. G.)

2793. Lefevre, Marcel. 1958. CONCERNING THE INFLUENCE OF ORGANIC MATTER ON THE NATURE AND ABUNDANCE OF PLANKTON. (DE L' INFLUENCE DES MATIERES ORGANIQUES SUR LA NATURE ET L'A BONDANCE DU PLANCTON.) Ann. Sta. Centrale Hydrobiol. Appl., Vol. 7, pp. 251-267; Biol. Abst., Vol. 33, No. 10, Abst. 36501, 1959.

Many algae grow better in the presence of partially decomposed organic matter. A pond at Berly (Cher) was long and narrow. Organic matter entered from a farm at one end and the outlet of the pond was at the other. There were more phytoplankton species at the enriched end than in the middle, and more in the middle than at the outlet end. Furthermore, the species at the enriched end were of a type more suitable for zooplankton, and hence for fish. In a pond at Rondeau (Seine-et-Oise) and there was a great deal of PO_4 present. The cause was a mystery until the pond was drained and a spring was uncovered. The spring water was rich in organic matter. In a pond at Clouzioux the plankton was very poor and fish fry were thin and delicate. 5 1/2 tons of liquid manure were spread in the 4 hectare pond. The phytoplankton developed well, and later the yield of fish was good. There are two main dangers inherent in adding organic fertilizer. Decay may deduce the O_2 to dangerous levels, and the bacteria and molds may produce toxic products. (C. C. D.)

2794. Sebestyen, Olga. 1957. STUDY ON ORGANIC SEDIMENT IN THE EROSION-LITTORAL OF LAKE BALATON. PARTI TANULMANY. Ann. Inst. Biol. (Tihany) Hungaricae Acad. Sci., Vol. 24, pp. 165-181. Illus. 1955-56; Biol. Abst., Vol. 33, No. 10, Abst. 36507, 1959.

On the shores of the Tihany peninsula, Lake Balaton, between November 1948 and December 1949 field observations and collection of samples were made in order to study the sediment which occurs here. The observations have been continued in order to complete and to control former data. Samples of the first year were subjected to both qualitative and quantitative studies, the recent ones are examined only for quality. In the shallow water of the erosion-littoral, detritus (förna) accumulates, which has its origin in the macrovegetation-growth in the close neighbourhood. It forms a more or less continuous belt about 1-3 m in width, and subjected to wave actions. In order to distinguish this kind of organic sediment from the detritus masses remaining within the vegetation growth and which, in the course of years, turns to sapropel, it might be named, „blown-detritus" (futodetritusz" in Hugarian). The blown-detritus serves as a habitat for small organisms. Its chief characteristic is that it does not remain in the locality of accumulation but, depending upon the wave action and water level moves about in a passive way. According to its location it exhibits three different conditions, 2 submerged and 1 terrestrial. In the sediment state it forms a continuous layer or occurs in patches especially at the bottom of ripple marks. This loose brown layer formed by small particles separates distinctly from the layer beneath, which consists mostly of inorganic particles, has a lighter color, a higher specific weight and a less loose construction. Keeping the layer condition the mass might be drifted here and there by slight currents When calm weather sets in a stagnation might follow. If the wave action is lively, the particles disperse in the shore water causing a brown color. This diffuse state might exit for several hours of even for days according to the duration and intensity of the wave action. The 2 submerged states mentioned above might be followed by a dryland state in forms of drifts and pseudodrifts. Following the diffuse state most of the disturbed particles are cast ashore and detritus drift results. The outcast masses or part of them are sprinkled by the waves for a while. This is significant from the point of view of life. A total drying of the detritus favours finer fragmentation. Among the environmental factors of the habitat the dynamic state of the water seems to be the most important one. The intensity of this factor has a wide am-

plitude resulting in extreme conditions of the environment. The impact factors such as temperature, light and O_2 works in combination with the effect of the water dynamics. (In calm water the lack of exchange is followed by stagnation. In the diffuse state the transparency of the water decreases. Nevertheless even more favourable light conditions may arise because the organisms themselves might be drifted closer to the surface.) These three states follow each other in an irregular order. The förna which furnishes the material basis for the habitat is present in various stages of disintegration and fragmentation. The condition of the förna causes the characteristic color to the habitat. Allochthonous elements being added occasionally to the autochthonous förna are always inferior in comparison to the latter one as to quantity. Fragments of exuvia of water insects in the larval or pupal stages are present and have a favourable effect on the structure of the förna They are significant also as substratum (Epistylis). Algae are common among the detritus particles, and diatoms occur in abundance, especially in winter. Fine detritus and diatoms form the principal food-source for the animal members of the association. Many animals known from the littoral are represented in the fauna of the habitat. They occur alive or in a dead condition or might be represented entirely or partly by their remnants and fragments. Among the animal members of the association coenobionts, coenophiles and coenoxenes might be distinguished. Two forms of Collotheca, one being cold stenothermous, the other one warm stenothermous, might be qualified as coenobionte members. Both of them exhibit a high degree of adaptation--in structure and way of life--to the extreme envionmental condition. Most of the others are coenophile (diatoms. Protozoa, Nematodes, Oligochaetes, most of the cladocerans, turbellarians and the water bear, Macrobiotus. The cladoceran fauna is various, Monospilus and Iliocryptus being most common. Very frequently Macroiotus macronyx occurs. Epistylis colonies are common; they are attached in most cases to frames of exuvium of arthropods. From this it might be concluded that their occurrence in the blowndetritus is tetiary (mud→neuston→blowndetritus). Other members occurring regularly are represented only by few individuals. In the course of this study certain details of the circulation of food materials within the lake were elucidated. It must be noted that in the circulation of food material particles of the biotop itself take part within the constructive processes of the circulation in general. The habitat in question is therefore a scene of an intimate contact of constructive and reductive processes. No clue whatever has been found as yet as to whether animals of larger size could make any use of this food material. It seems possible that bottom feeding fish consume habitat and inhabitants without any selection. In the course of this study the origin of the fauna of the detritus drifts was iluminated. It is evident that detritus drifts are identical with the terrestrial state of blowndetritus. This paper is a continuation of former studies published by the author and coworkers, on detritus, on littoral and mudliving Cladocera and on two forms of the Rotifera Collotheca (From auth. summ.)

2795. Vivier, Paul. 1958. AN EXAMPLE OF ANCIENT ACCLIMATIZATION: THE COREGONIDS OF THE LAKES OF THE MASSIF CENTRALE. (UN EXEMPLE D' ACCLIMATATION ANCIENNE: LES COREGONES DES LACS DU MASSIF CENTRAL.) Ann. Sta. Centrale Hydrobiol. Appl., Vol. 7, pp. 239-250 ; Biol. Abst., Vol. 33, No. 10, Abst. 36509, 1959.

About 100 years ago there was an intensive effort to introduce new, valuable fish into French lakes. Eggs or fry of coregonids were planted in many places, but most localities were unsuitable. In the Massif Centrale, apparently the coregonids were successful only in Lac d' Issarles and Lac Chauvet. Both are small, deep lakes, probably oligotrophic. Both lie at about 1000 m altitude, and are in extinct volcanic craters. In Lac d'Issarles the original introductions took place in the years 1858-1862, and in Lac Chauvet in 1869-1870. The coregonids of the two lakes are very different. Each type is described in some detail. The form in Lac d'Issarles is a hybrid between the gangfish (C. macrophtalmus) and the sandfelchen (C. schinzi). The form in Lac Chauvet is almost identical to C. albula (which exists only in northern Germany). (C. C. D.)

2796. Aoyama, Tsumeo. 1957. ON THE REGENERATION OF THE TELEOST SCALE, WITH SPECIAL REFERENCE TO THE YELLOW SEA BREAM, TAIUS TUMIFRONS. Japanese Soc. Sci, Fish,. Vol. 22, No. 11, pp. 679-684 ; Biol. Abst., Vol. 33, No. 10, Abst. 36510, 1959.

The ratio of regenerated scales to normal ones was observed, as well as the estimated age at which the scale was regenerated in samples from about 263 yellow sea bream caught in the East China Sea, from Nov., 1951, to Oct., 1952. Median value of the apparent regeneration ratios of scales of each age class increase by about 6% per year of age (maximum 76.5%, minimum 0.8%). The Polya-Eggenberger type distribution is applied approximately to the frequency distribution of the apparent regeneration ratio of scales in each estimated age stage. No significant difference is observed in this ratio between the northern and southern areas, between sexes, or between 2d and 3d year-classes. The ratio of the number of samples carrying no regenerated scale to the total number shows a relatively high value of 6.8% for the 0 and 1 year-classes, but it less than 3% at age 2 and older. The average regeneration ratio of scales is 4.5 so for the 0 and 1 year-classes, 4.9% at age 2 and more than 6% at age 3 and older. From these facts and other ecological and morphological data, it is concluded that the scales fall off more frequently because of physiological causes rather than mechanical ones. (Author)

2797. Hirayama, N. 1957. ON THE SCHOOL OF YELLOW-FIN TUNA, NEOTHUNNUS RARUS (K.), DEDUCED FROM THE DISTRIBUTION OF CATCH ON TUNA LONG LINE. Bull. Japanese Soc. Sci.

Fish, Vol. 23, No. 7/8, pp. 373-385 ; Biol. Abst., Vol. 33, No. 10, Abst. 36514, 1959.

The distribution of catch on the tuna long line is analyzed and a configuration for a yellow-fin tuna school is proposed. (Author)

2798. Kaj, J. 1958. SPAWNING OF FISH IN THE LOWER STRETCH OF THE WELNA RIVER. (PRZEBIEG TARLA RYB W DOLNYM ODCINMKU RZEKI WELNY.) Pokskie Arch. Hydrobiol. Vol. 4, pp. 183-192 ; Biol. Abst., Vol. 33, No. 10, Abst. 36519, 1959

It is proposed to establish a fish reservation in the lower stretch of the Welna River (Warta river basin), known from mass spawning of a number of fish species belonging to the family Cyprinidae, and as a sporadic and peak spawning place of sea trout and salmon. Observations were conducted in 1955 on spring spawning of fish for the purpose of determining its time and duration, and the correlation between spawning intensity and hydrological and climatic factors. The number of fish present in the spawning place during the period May 5th to July 3, 1955 was approximately 7000 Vimba vimba, 600 Leucisus cephalus, 150 Barbus barbus, 300 Chondrostoma nasus and 6000 Alburnus alburnus. Spawning of Vimba vimba took place at a water temperature of 15.2°C, stopping with a decline of the water temperature to 14°C. Greatest intensity of spawning was noted at 19.6°C. A similar interrelation between spawning intensity and water temperature was noted in the case of B. barbus and L. cephalus. Spawning of C. nasus was still observed at a temperature of 13.6°C, and of Alburnus alburnus at 14°C. As a rule the effectiveness of natural spawning exceeded 80%. Samples of spawn taken, the area of the spawning place and number of females of different species, served as a basis for estiminating the amount of spawn layed. This amount was estimated at 160 million eggs for V. vimba, 3 million for L. cephalus. The necessity of establishing a reservation in the mentioned stretch of river - even in of light of observations conducted over one season only and of the imperfect methods of study - seems to be obvious. (Auth. summ.)

2799. Anonymous. 1957. THE TOXICITY OF CHEMICALS ON FISH. II. THE ESTIMATION OF THE EFFECTIVENESS OF INSECTICIDES ON THE YOUNG CARP, CYPRINUS CARPIO LINNE. Bull. Japanese Soc. Sci. Fish, Vol. 22, No. 10, pp. 641-644 ; Biol. Abst., Vol. 33, No. 10, Abst. 36526, 1959.

The effectiveness of insecticides on young carp was determined, and the LD_{50} for each insecticide is given. The time in which fish are killed by the insecticide is related to the concentration of insecticide by an equation from which Ostwald's formula may be obtained. (Auth. abst.)

2800. Anonymous. 1958. LIST OF PUBLICATIONS FROM THE DEPARTMENT OF FISHERIES, FACULTY OF AGRICULTURE, KYOTO UNIVERSITY DURING THE PERIOD 1947-1957. Mem. Coll. Agric. Kyoto Univ. Fish. Ser. Special Number 1958, pp. 3-22; Biol. Abst., Vol. 33, No. 10, Abst. 36527, 1959.

Lists the published contributions (316) of the members of the staff in the field of fishery science and technology. Those published in Japanese, usually with English summary, are indicated, all others are in English. (K.B.)

2801. Ramaswami, L.S., and B.I. Sundararaj. 1958. ACTION OF ENZYMES ON THE GONADOTROPHIC ACTIVITY OF PITUITARY EXTRACTS OF THE INDIAN CATFISH HETEROPNEUSTES. Acta Endocrinol, Vol. 27, No. 2, pp. 253-256; Biol. Abst., Vol. 33, No. 10, Abst. 37394, 1959.

The catfish pituitary contains a gonadotropic hormone that brings about ovulation in fish. When trypsin or pepsin are used as digestants, under certain conditions, the hormone is either destroyed or inactivated by trypsin or pepsin. (MDS.)

2802. Suyama, M. 1958. CHANGES IN THE AMINO ACID COMPOSITION OF PROTEIN DURING THE DEVELOPMENT OF RAINBOW TROUT EGGS. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol. 23, No. 12, pp. 789-792; Biol. Abst., Vol. 33, No. 10, Abst. 37947, 1959.

The total proteins of the unfertilized eggs and the larva at some developmental stages of rainbow trout, Salmo irideus, were analyzed in respect to amino acid composition by the chromatographic technique, using a Dowex 50 column. The amino acid composition of total protein of unfertilized eggs bears some resemblance to that of vitellin prepared from the yolk of chick-eggs, except as to alanine and serine contents. The unfertilized eggs show some changes in the amino acid composition of the protein during development; the contents of arginine, aspartic acid, glutamic acid, glycine, hydroxyproline, lysine, methionine, and proline tended to increase, while the contents of alanine, isoleucine, leucine, phenylalanine, serine, threonine, valine, and amide-nitrogen tended to decrease. A discussion is given regarding the consumption of total N and the formation of fish muscle protein during development, based upon the rise and fall of glycine, glutamic acid, amide-nitrogen, etc. (Author)

2803. Arasaki, S., K. Nozawa, and M. Miyake. 1958. ON THE PATHOGENETIC WATER MOLD. I. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol. 23, No. 9, pp. 534-538; Biol. Abst., Vol. 33, No. 10, Abst. 38557, 1959.

Observations were made on the life cycle and pH suitable for growth of the pathogenetic Saprolegnia spp. isolated from some fungus-diseased fishes, eels and eggs of fish. Almost all the fungi were Saprolegnia parasitica Coker. Some of the others seemed to belong to a strain of the same species, but could not be correctly identified. A few were believed to be a strain that has rather stronger resisting power against malachite green. In simple peptone medium, the mycelium continued to grow, whereas in the distilled water it formed zoosporangia. Gemma were formed in low temperature (below 15°C) or after a

long culture period. Gemma formed numerous zoospores just as the zoosporangia did, and it seemed that there might be no essential difference between zoosporangia and gemmae. The growth ratio of the mycelium measured in volume was shown as a sigmoid curve that had a rather long straight part. The same strain had almost the same top point in optimum pH, near the neutral point. But some seemed to show the after effect of their native ponds. The pH value of the culture medium gradually approached the optimum value in the course of culture. Correlation between growth and pH in agar plate culture was quite different from that in solution culture. (Authors)

2804. Arasaki, S., K. Nozawa, and M. Miyaki. 1958. ON THE PATHOGENETIC WATER MOLD, II. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol. 23, No. 10, pp. 593-598; Biol. Abst., Vol. 33, No. 10, Abst. 38558. 1959.

The resistance of S. parasitica against malachite green was variable at different life stages. The growth of hyphae was restrained completely in peptone solution with 0.02 ppm. and the formation of zoosporangia or gemmae along with the germination of resting spores, was checked with 0.2ppm. The concentration of malachite green and the time needed to kill the hyphae or sporangia on the eggs of Hypomesus olidus was a straight line when both factors were expressed in logarithm. As the infection of the disease could not be checked unless the formation of zoospore ceased, it may be safely said that the disease is carried chiefly through zoospores. It is suggested that in controlling the disease, it may be enough to treat the trout eggs for about 20 minutes in 5 ppm of the dye, and in the case of the eel it may be necessary to use a more concentrated solution than 0.2ppm. (Authors)

2805. Hilsenhoff, William L. 1959. THE EVALUATION OF INSECTICIDES FOR THE CONTROL OF TENDIPES PLUMONSUS (LINNAEUS). Jour. Econ. Ent. Vol. 52, No. 2, pp. 331-332; Biol. Abst., Vol 33, No. 10, Abst. 39227, 1959.

In laboratory tests, 16 commercially available organophosphate insecticides were screened to determine their relative toxicity to larvae of Tendipes plumosus (Linnaeus) and to the fathead minnow, Pimephales promelas Rafinesque. DDVP, Dipterex, EPN, Guthion, malathion, and Phosdrin all showed considerable toxicity to the larvae at concentrations of 0.1 pounds or less per acre of the technical material incorporated into granules. Of these six insecticides, DDVP at 50 pounds per acre, Dipterex at 100 pounds per acre, and malathion at 20 pounds per acre showed no toxicity to the minnows in replicated tests. These same three insecticides, in replicated tests, all produced 97% mortality of T. plumosus larvae within 7 days at concentrations of 0.75 pounds per acre and Dipterex produced 97% mortality at 0.05 pounds per acre. (Auth. abst.)

2806. Holmgren, Uno. 1958. ON THE PINEAL ORGAN OF THE TUNA, THYNNUS THYNNUS L. Breviora, Mus. Comp. Zool. (Harvard), 100, pp. 1-5, Illus; Biol. Abst., Vol. 33, No. 10, Abst. 39525, 1959.

The morphology of the pineal organ, situated below a conspicuous pineal spot and pineal fontanelle is described. Some functional aspects on the connection between the pineal and phototaxis are discussed. (Author)

2807. Kurogane, K., and Y. Hiyama. 1957. MORPHOMETRIC COMPARISON OF THE YELLOWFIN TUNA TAKEN FROM THE EQUATORIAL PACIFIC. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol. 23, No. 7/8, pp. 388-393; Biol. Abst., Vol. 33, No. 10, Abst. 39528, 1959.

Several samples of yellowfin tuna, Neothunnus macropterus, from the Equatorial Pacific ranging from 130° W to 130°E were compared in 16 different body characters. Specimens of yellowfin taken from the same area in different years show difference in maxillary length, anal length and spread caudal, but generally they have considerably similar morphometrical characteristics. There is a much greater degree of separation between 170° W and 150°E and between 160°W and 130°W than between 150°E and 130° E and between 170°W and 160°W. The specimens of yellowfin from the area of 160°W have a shorter head, a more anterior ventral and pectoral fin than those from the eastward and westward regions. In eye diameter, 2d dorsal and anal length, the measurement is the greatest in the Western Pacific and the least in the Eastern Pacific. It is probable that there is at least 3 independent populations with some mixing between each other. (Authors)

2898. Tsuruta, Saburo. 1955. MORPHOMETRIC COMPARISON OF YELLOWFIN TUNA OF SOUTH—WESTERN GREAT SUNDA ISLANDS AND OF THE PACIFIC WATER. (IN Japanese with English summ.) Jour. Shimonoseki Coll. Fish Vol. 4, No. 3, pp. 311-319; Biol. Abst., Vol. 33, No. 10, Abst. 39538, 1959.

In the yellowfin tuna, the growth rate of body parts is the greatest in anal fin and smallest in pectoral from the material obtained from S. W. G. S. I. (South Western Great Sunda Islands). These are supported by samples found in all other wider areas. The specimens of S. W. G. S. I. far surpass those of other areas in length of 2d dorsal fin and of anal fin. These fin shapes decidedly stand at variance with that of corresponding ones in the samples of the above mentioned 2 regions. The specimens of S. W. G. S. I. do not differ from those of other wider areas in head length and body depth. The same tendency is evident in the growth rate of them. All other features show little differences between the specimens of the 2 areas. It is concluded that yellowfin tuna may be considered as a partly independent stock all over the world but probably related to a single species. (Auth. summ.)

2809. Zarnecki, S. 1958. POPULATION OF SILESIAN VISTULA TROUT SPAWNERS IN 1954. (POGLOWIE TARLAKOW PSTRAGA Z WISLY SLASKIEJ Z ROKU 1954.) (In Polish with Russian and English

summ.) Polskie Arch. Hydrobiol., Vol. 4, pp. 207-220. Illus; Biol. Abst., Vol. 33, No. 10, Abst. 39540, 1959.

Investigations conducted on the age and rate of growth of the brown trout (Salmo trutta m. fario) population spawning in Oct. 1954 in the trout region of the Silesian part of the Vistula River. From the 1515 spawners caught by electric fishing samples of scales were taken from 350 individuals. Material from 272 individuals was useful for the determinations. Age of spawners. Only around 1% of 2 year-trout participate in spawning. Around 63% of the trout were 3 years old, 32% - 4 years old, 2.5% - 5 years old. Older individuals were found singly. The oldest spawner (female) in the population under study was 8 years old. Growth reached during subsequent years of life in the river is given. Average weight of specific weight classes is shown. Due to the lack of 1-year old individuals among the spawners, and the very small number of 2-year-olds, their growth during specific years was computed by means of Lea' method. Comparisons were made between the results of back calculation and by direct measurement. These comparisons showed perfect agreement. Lengths of specific age groups obtained by back calculation are presented. The brown trout of the Silesian Vistula region reaches an average of: 9.4 cm after the 1st year, 17.2 cm after the 2d year, 23.2 cm after the 3d year, 27.5 cm after the 4th year. This growth should be accepted as normal and economically satisfactory. Fear of dwarfing due to intensive stocking was not confirmed by the results obtained in these investigations. Length increments attained in the Vistula are very similar to those fixed recently for the brown trout of the Fulda region in Germany, and of certain Swedish waters (K. Müller). The population caught in Oct. showed that of the 272 individuals under study, 89.3% already had winter rings at this time. This can be explained by the retarded rate of growth due to limited feeding during the period of spawning, and to the action of sexual glands also inhibiting growth. In the population under observation, 12.13% showed immature gonads. Some of these possessed a silver exterior or its beginnings. This leads to the assumption that part of the trout population is subject to smolt metamorphosis, and can migrate to the sea as sea trout. In this case the observed facts are of interest, since the area under observation has not been stocked for many years past with sea trout, and no anadromous forms can reach it due to lower lying sewage barriers. (Auth. summ.)

2810. Kanda, K., and A. Loike. 1958. A STUDY ON THE COLOR OF FISHING NETS. I. OBSERVATIONS ON THE PASSAGE OF FISHES THROUGH A COLORED NET. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol. 23, No. 10, pp. 612-616; Biol. Abst., Vol. 33, No. 11, Abst. 40068, 1959.

The fish barring effect of colored nets decreased in the following order: red ≥ yellow ≥ green, while black, gray and white produced different effects according to the species of fish tested. The number of fish which passed through red, yellow and green nets does not vary with intensity, but seems to depend on the color of the reflected light. Fishes behaved differently even to nets of the same color if the light source was changed. Contrast may have been a factor. (From auth. summ.)

2811. Kanda, K., A. Loike, and M. Ogura. 1958. A STUDY ON THE COLOR OF FISHING NETS. II. BEHAVIORS OF FISH SCHOOLS IN THE NEIGHBORHOOD OF A COLORED NET. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol. 23, No. 10, pp. 617-620; Biol. Abst., Vol. 33, No. 11, Abst. 40069, 1959.

Two pieces of different colored nets were combined and stretched in an outdoor pool (length 26 m; width 5 m; depth 1.5 - 0.7 m). The behavior of a school of rainbow trout, Salmo gairdnerii irideus (Gibbons) in the neighborhood of the net was observed. A large difference in number of fish passing through is detectable between individual pieces of net; the fish school behaves quite specifically according to the hue of the net. The colors examined were red, orange, yellow, green, and blue; and effectiveness of these colors for fish passage increased in the order: green ≥ blue ≥ yellow = prange ≥ red. Thus, relative passability for fish estimated for individual nets on the basis of green net varied with the dominant wavelength of the reflected light. No marked difference is detectable between the curves drawn for the distribution of spectral light in the pool water on the one hand and for the relative intensity of light reflected respectively from blue and green nets, on the other. This suggests that the weak barring effect of a blue or green net against fish passage may be attributable to a weakness of contrast between these nets and their surroundings. (Authors)

2812. Kanda, K., A. Loike, and M. Ogura. 1958. A STUDY ON THE COLOR OF FISHING NETS. III. EFFECT OF THE DEPTH OF COLOR OF A NET ON THE BEHAVIOR OF A FISH SCHOOL NEAR THE NET. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol, 23, No. 10, pp. 621-624; Biol. Abst., Vol. 33, No. 11, Abst. 40070, 1959.

In a fish school (Salmo gairdnerii irideus) approaching nets of the same color but of different intensity, no difference was detected with blue, green, red, or brown. Intensity affects fish behavior independently of color. During daylight observations on fishes schooling near nets of various colors, it was found that a black net was least effective in fish stopping action. (From auth. summ.)

2813. Kanda, K., and A. Koike. 1958. THE STUDY ON THE COLOR OF FISHING NETS. IV. A CHANGE IN ILLUMINATION AFFECTING THE BEHAVIOR OF A FISH SCHOOL NEAR A COLORED NET. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol. 23, No. 11, pp. 680-683; Biol. Abst., Vol. 33, No. 11, Abst. 40071, 1959.

2814. Kusaka, T. 1958. EXPERIMENTS TO SEE THE EFFECT OF COLOR AND ITS DEPTH ON THE

DRIVING NET BY THE CENTRALIZING METHOD. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol. 23, No. 12, pp. 766-769; Biol. Abst., Vol. 33, No. 11, Abst. 40076, 1959.

10 goldfish (Carrassius auratus) of an average length of 3.5 cm were liberated in a wooden tank 50 cm long, 26 cm wide, filled to a depth of 10 cm. Two model nets, wooden frames with stretched netting of small mesh, were arranged with 3 glass tubes in the middle. Red, blue and black inks were used to fill each tube. For changes in color intensity these inks were diluted from 10-1000 times. Driving effect changes with color change. There was a recognized change of effect according to color intensity, and the visible distance of glass tubes in the water coincides with it. The most visible color is not always best in the driving effect. Undiluted red ink is most effective. (From auth. summ.)

2815. Tsukuda, Hiroko, and Tosiko Katayama. 1957. TEMPERATURE ADAPTATION IN FISHES. I. THE INFLUENCE OF REARING TEMPERATURE ON TEMPERATURE TOLERANCE, GROWTH RATE, AND BODY FORM. (In Japanese with English summ.) Physiol. and Ecol. (Japan) Vol. 7, No. 2, pp. 113-122, Illus; Biol. Abst., Vol. 33, No. 11, Abst. 40111, 1959.

The guppy, Lebistes reticulatus, and the medaka, Oryzias latipes were kept at 20°, 25°, and 30° C, and the influence of the environmental temperatures observed. The temperature tolerance was found by gradually increasing or lowering (1°C per 3 minutes) the water temperature. The mean values for guppies kept for 5 weeks at 25°C were 40.5° and 11.8°. Those for Oryzias latipes kept for 4 months were 41.4° and 4.5° C. The 30° groups for both groups showed gain in heat tolerance and loss in cold tolerance and loss in cold tolerance: for cold, 1.0° in Lebistes, 2.3° in Oryzias; for heat 0.3° in Lebistes and 1.0° in Oryzias. The opposite effect was observed in the groups kept at 20°C. Lebistes showed a 1.5° loss in heat tolerance and 0.7° gain in cold tolerance; Oryzias showed a 2.4° gain in cold tolerance and a 1.9° loss in heat tolerance. In both species the growth rate was greatest at 25° and smallest at 20°C. Population density had a considable effect on growth rate, growth was remarkedly better at low density (10 individuals/2 liter) than at high density (20 individuals/2 liter). Body form was compared after 4 months among the 3 temperature groups of Lebistes reticulatus. In both sexes, the relative height measured at 2 different positions increased with temperature. Pectoral fin length and head size were little influenced. In the group raised at 30°C there appeared individuals with abnormally curved or crooked vérebral columns. Bending was doubled in some individuals, and in some it was lateral as well as dorsoventral. Within 16 weeks the rate of occurrence of this abnormality among the surviving fish reached 100%. Eggs spawned by females of Oryzias latipes which had been reared at 20°C were divided into 3 groups and kept at 20°, 25°, and 30°C. Development was more rapid in the order: 30°, 25°, 20°C. The eggs from the 20° female hatched 1-2 days earlier than those from the 25° female, though the latter preceded the former in the early developmental stages. (MDS.)

2816. Curry-Lindahl, Kai. 1957. THE OCCURRENCE OF THE CHAR, SALMO ALPINUS, IN RUNNING WATERS IN ARCTIC AND HIGH BOREAL AREAS IN SWEDEN. K. Fysiogr. Sällskapets i Lund, Forhandl. Vol. 27, pp. 161-172. Map; Biol. Abst., Vol., 33, No. 11, Abst. 40122, 1959.

S. alpinus and S. trutta overlap in highly situated lakes, where competition is known to occur between the 2 species, but in such habitats they may live side by side in different ecological niches. In running waters at lower altitudes trout, which is mainly territorial, seems to compete successfully with char, at least in waters within its southern range. Probably also hunting methods of S. Trutta, with swift charges from its site, favor this species in relation to char. In some rivers situated more to the north, both species occur. A large river with different velocities may be divided ecologically in the same way as lakes. In subalpine and alpine regions S. alpinus occurs alone both in lakes and streams. In mountains char often migrates upwards as far as possible. (From auth. summ.)

2817. Kawanabe, H., N. Mizuno, and N. Nishimura. 1957. POPULATION DENSITY OF A SALMON-LIKE FISH, PLECOGLOSSUS ALTIVELIS, OR AYU, IN DIFFERENT RIVER-BEDS. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol. 23, No. 7/8, pp. 430-434; Biol. Abst., Vol. 33, No. 11, Abst. 40133, 1959.

Generally speaking, population density of this fish in the residential season, which follows the upstream migratory season, is highest in rapids of boulder bottom, and lowest in pools of shallow sandy bottom. In rapids and pools with rock walls, utilization varies. Rapids of stone and gravel bottom are utilized uniformly. While rapids with boulder bottom are occupied by both large and small fishes, rapids of stone and gravel bottom and pools of shallow, sandy bottom are in general habitats for smaller fishes, and rock wall pools for larger ones. (Authors)

2818. Kawanabe, H. 1957. SOCIAL BEHAVIOR AND PRODUCTION OF A SALMON-LIKE FISH, PLECOGLOSSUS ALTIVELIS, OR AYU, WITH REFERENCE TO ITS POPULATION DENSITY. (In Japanese with English summ.) Japanese Jour. Ecol. Vol. 7, No. 4, pp. 131-137; Biol. Abst., Vol. 33, No. 11, Abst. 40134, 1959.

This fish has been studied since 1955 in the River Ukawa on Japanese Sea coast and 5 types were recognized according to social behavior: schooling, solitary traveling, non-territorial solitary residential, solitary territorial, and aggregated. The social type of this population appears to change with reference to its density, and this change is accompanied by the difference in body-length and distribution. (R. T.)

2819. Hildebrand, Henry H. 1957. PRELIMINARY BIOLOGICAL STUDIES ON LA LAGUNA MADRE DE

TAMAULIPAS. (ESTUDIOS BIOLOGICOS PRELIMINARES SOBRE LA LAGUNA MADRE DE TAMAULIPAS. Ciencia (Mexico) Vol. 17, No. 7/9, pp. 151-173. Map; Biol. Abst., Vol. 33, No. 11, Abst. 40182, 1959.

The Laguna Madre de Tamaulipas is a shallow hypersaline lagoon varying greatly in salinity. An undetermined portion, probably in excess of 1000 sq. km in the northern part, had salinities too high for fish life during the recent drought, and has passed through several productive and non-productive cycles since first commercial fishery in 1911. In contrast, Punta Piedras at the south is the focal point of an intense and productive fishery. Salinities of 41-48‰ were measured there during Oct.-Nov., 1953, and March, 1954; in the north salinities were 108-117‰ in March, 1955. Judging by old oyster shells in areas where none now grow, it is thought that there has been a long-term trend toward more saline conditions there, accentuated in recent years by water-use policies on the Rio Grande and Rio San Fernando. At Punta Piedras 2 communities of bottom plants were recognized: in the inshore zone of the 0.30 contour, a soil-binding blue-green algal complex predominates, in water from 0.30-1.50 is a dense submerged meadow composed chiefly of Diplanthera and Acetabularia. To the north where salinities exceed 100‰ there are no plant communities and the bottom is covered with calcium sulphate. In that area an Ephydra fly community was recognized. In the South 27 invertebrate and 59 fish species were recorded. On the basis of fish fauna the Laguna is classified with the warm temperate fauna of the northern Gulf coast, although an abundance of species characteristic of the West Indian fauna were noted. Commericial species are listed and depletion of the redfish Sciaenops ocellata is attributed to alternation of its habitat through hypersalinity. (Author)

2820. Matsue, Y., T. Endo, and K. Tabata. 1957. EFFECT OF AN INSECTICIDE, PARATHION, ON AQUATIC ANIMALS AT LOWER RANGES THAN ITS LETHAL CONCENTRATION. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol. 23, No. 7/8, pp. 358-362; Biol. Abst., Vol. 33, No. 11, Abst. 40203, 1959.

Goldfish (Carassius auratus) and Japanese killifish (Oryzias latipes) were kept for about a month in water containing parathion (Diethyl-para-nitrophynylthiophate) in various concentrations below its lethal value and its toxicity upon fish observed. The insecticide proved harmful to fish even at concentrations as low as 1/30th of its 48h-TLm (median tolerance limit). Growth was retarded due to the decrease in the amount of food eaten. The permissible concentration of parathion upon aquatic animals should be regarded as far lower than the value of 48h-TLm x 0.1, which is now considered permissible for general pollutants. (Authors)

2821. Nakamura, Takehiko. 1956. RIVER POLLUTION BY SULPHIDE MINE WASTES. (In Japanese with English summ.) Bull. Fac. Agric. Univ. Miyazaki Vol. 1, No. 2, pp. 247-251; Biol. Abst., Vol. 33, No. 11, Abst. 40204, 1959.

Two kinds of wastes were discerned, underground water from the pyrite mine mixed with washed water from the ore, and a solution containing slime from a flotation process. The 1st is poured into the river without treatment. The other is subjected to settling and to neutralization by calcium carbonate powder in 2 settling ponds. Water and muddy deposits were sampled at various points along the river and analyzed for various components, pH, O_2, $KMnO_4$ consumption, Cl, SO_4 and Fe. Pollution varied according to the site; tributaries and the natural clarifying properties of the river altered it. Pollution was found in mud even relatively far downriver. The author suggests that in examinations for water pollution it is important contaminants not readily discernible in the water itself. (MDS.)

2822. Anonymous. 1958. OXYGEN RELATIONSHIPS IN STREAMS. U.S. Publ. Health Serv. Robert A. Taft Sanitary Engineer. Cent. Tech. Rept. W58-2. pp. 1-194 Portrait; Biol. Abst., Vol. 33, No. 11, Abst. 40207, 1959.

Technical report W58-2 of the Robert A. Taft Sanitary Engineering Center, the 194-page volume contains the proceedings of a seminar sponsored by the water supply and water pollution program of the Center in Nov. 1957. Topics include the use of stream data in the administration of pollution abatement programs, dissolved oxygen requirements for fishes, the oxygen sag equations, measurement and calculation of stream reaeration ratio, significance of organic sludge deposits, a report of a Thames Estuary study, mixing and diffusion of wastes in streams, effects of impoundments on oxygen resources, sampling and analytical methods in stream studies, application of stream data to waste treatment design, and the effects of algae on dissolved oxygen and biochemical oxygen demand.

2823. Inaba, D., M. Nomura, and K. Tominaga. 1958. STUDIES ON THE IMPROVEMENT OF ARTIFICIAL PROPAGATION IN TROUT CULTURE. --1. ON THE INTERFERENCE OF THE BROKEN EGGS AND EFFECT OF THE EGG WASHING METHOD. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol. 23, No. 12, pp. 758-761; Biol. Abst., Vol. 33, No. 11, Abst. 40211, 1959.

It is very difficult to extrude eggs from ripe females without breaking some and broken eggs seriously interfere with fertilization. The eggs are extruded on a net receiver and washed in isotonic salt solution (dissolved NaCl 55.05 g, KCl 1.97 g and $CaCl_2 \cdot 2H_2O$ 3.14 g in 7.5 l water). The eggs are poured into the pan which contains a small quantity of isotonic salt solution and fertilized in the same manner as the usual dry method. The authors studied the interference of the broken

eggs in the fertilization of the rainbow trout eggs and compared the number of eyed eggs obtained between the dry method and the egg washing method. When more than 25 broken eggs were contained in 100 cc coelomic fluid, all the sperm coagulated and did not move. No eyed eggs were obtained when the broken eggs were 3% of the normal stripped eggs. In order to obtain above 80% eyed eggs, the number of broken eggs should be less than about 0.15% in the normal eggs. The egg washing method is more useful than the dry method in the fertilization of trout eggs when broken eggs are present among the stripped eggs. (Authors)

2824. Inaba, D., M. Nomura, and M. Suyama. 1958. STUDIES ON THE IMPROVEMENT OF ARTIFICIAL PROPAGATION IN TROUT CULTURE. --11. ON THE PH VALUE OF EGGS, MILT, COELOMIC FLUID AND OTHERS. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol. 23, No. 12, pp. 762-765; Biol. Abst., Vol. 33, No. 11, Abst. 40212. 1959.

The pH values of eggs, milt and coelomic fluid of rainbow trout were, measured with Beckman pH meter G type and their results were compared with the percentages of eyed eggs obtained by each brood fish. The pH value of the testis has a tendency to increase gradually from the anterior part toward the posterior. The pH value of milt varies from 7.84 to 8.14 and averages 8.03 + 0.05. The pH value of the transparent fluid which is stripped with milt is 6.25 on average, and this fluid coagulates the sperm and stops its movement. Therefore, care should be taken to prevent mixing this fluid with the normal sperm. The sperm moves within the range of nearly 4.5 to 10.4 pH value and its movement tends to be more active in the basic range of pH. The pH value of the egg surface is 8.10-8.59, average 8.27 + 0.80. The pH value of egg content is 6.53-668, average 6.63 + 0.01. Eggs which showed survival rate below 80% had a pH range below 8.2 for the egg surface. The pH value of the coelomic fluid is 7.61-8.14 and its value decreases as the number of broken eggs in the coelomic fluid increases. (Authors)

2825. Inque, M. 1958. STUDIES ON MOVEMENTS OF ALBACORE FISHING GROUNDS IN THE NORTHWEST PACIFIC OCEAN. --1. ADAPTABILITY OF WATER TEMPERATURES FOR ALBACORES IN THE WINTER SEASON FROM OBSERVATIONS OF RECORDS ON CATCHES AND OPTIMUM WATER TEMPERATURES BY FISHING BOATS. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol. 23, No. 11, pp. 673-679; Biol. Abst., Vol. 33, No. 11, Abst. 40213, 1959.

Albacore tuna schools moving southward in the winter-spring period in the Northwest Pacific Ocean adjacent to Japan are divided into surface swimming tunas taken by pole fishing, and deep swimming tunas taken by long-line fishing. The migration of albacores in the winter-spring period is seasonal. From analysis of fishery reports on albacore fishing for the period 1951-56 regarding the seasonal migration between 25° and 40°N, and 130° and 180°E. it was found that (1) the optimum temperatures in albacore "life zones" are variable, and there is a tendency to a higher optimum temperature for large-sized tunas and lower temperature for small-sized tunas; the water zones under 16.3° and over 22, 8°C are regarded as "environmental barriers" which prevent albacore migration, and also the formation of fishing grounds. Albacores moving southward in winter, and northward in early spring, have "life zones" of different optimum temperatures; higher temperature for large-sized tunas, and the lower temperature for small-sized tunas. (Author)

2826. Nakagome, J. 1958. ON THE SEASONAL VARIATION OF SWIMMING LAYERS OF YELLOWFIN TUNA, BIG-EYED TUNA AND BLACK MARLIN IN THE AREA OF CAROLINE AND MARSHALL ISLANDS. 1. ON THE SEASONAL VARIATION OF SWIMMING LAYER. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol. 23, No. 9, pp. 518-522; Biol. Abst., Vol. 33, No. 11, Abst. 40215, 1959.

The depth of the swimming layer of yellowfin tuna is shallower (about 115 m) in late spring, and deeper (about 150 m) in autumn, those of bigeyed tuna are shallower (110-120 m) in the late spring from Nov. to Dec., and deeper (140-150 m) in autumn and Jan. In the Black Marlin depth decreases from about 160 m in spring to about 100 m in Dec. (Author)

2827. Nakagome, J. 1958. RELATION BETWEEN SEASONAL VARIATION OF SWIMMING LAYER OF YELLOWFIN TUNA AND BIG-EYED TUNA AND VERTICAL DISTRIBUTION OF CHLORINITY. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol. 23, No.9, pp. 523-524; Biol. Abst., Vol. 33, No. 11, Abst. 40216, 1959.

No relation between the swimming layer and vertical distribution of chlorinity was found in the area of the Caroline and Marshall Islands. (Author)

2828. Van Bemmel, A.C.V. 1957. FISH SPECIES ON THE VERGE OF EXTINCTION IN THE NETHERLANDS. (VISSOORTEN DIE UNIT DE NEDERLANDSE FAUNA DREGEN TE VERDWIJNEN). Levende Natuur. Vol. 60, No. 5, pp. 109-114; Biol. Abst., Vol. 33, No. 11, Abst. 40219, 1959.

River regulation, construction of weirs, and water pollution have brought many fish species, once abundant in the Netherlands waters, on the verge of extermination. Some species, Alosa alosa and Coregonus oxyrhynchus have already disappeared. It seems almost certain that Salmo salar, Acipenser sturio, and Chondrostoma nasus will follow before long. Some other species, through of very local occurrence, (Siluris glanis, Lampetra planeri, Lota lota, and Phoxinus phoxinus), are presumably able to eke out their existance under the present conditions. (P. K.)

2829. Walford, Lionel A. 1958. SOME PROBLEMS FOR BIOLOGICAL FISHERY SURVEY AND TECHNIQUES FOR THEIR SOLUTION. A SYMPOSIUM HELD AT BIARRITZ, FRANCE, MARCH 1-10, 1956. Internatl. Comm. Northwest Atlantic Fish. Spec. Publ. Vol. 1, pp. 1-339. Illus. Maps; Biol. Abst., Vol. 33, No. 11, Abst. 40220, 1959.

The following papers appear in this issue:-The problem of sampling oceanic stocks which are partly demersal, partly pelagic, whose distribution differs with size and age, and which are fished by diverse techniques and by diverse countries, CLYDE C. TAYLOR; Characteristics of the catches of the salt cod fleet, W. R. MARTIN; Population dynamics: Devise means of reducing the time required to obtain data necessary for making assessments of stocks, especially those required as the basis for a program of conservation, S. J. HOLT; Mortality estimation in partially fished stocks, R. J. H. BEVERTON and J. A. GULLAND; Fish population assessment by inspection, MICHAEL GRAHAM; Sampling of semi-oceanic stocks of fish, J. A. GULLAND; The evaluation of fisheries resources by the dynamic analysis of stocks, and notes on the time factors involved, S. J. HOLT; Some observations on methods of speeding up fish population assessments, E. D. Le CREN; To make the best use of the scientific talent, arrange that men with special skills are most effectively used for the needs of the whole commission. This may require allocating tasks and materials, L. A. WALFORD; Effects of haddock mesh regulation in Subarea, HERBERT W. GRAHAM; Comparison of European and North American techniques of measuring nets, of reading ages of fish and of studying growth, B. B. PARRISH; Some considerations concerning the instrumentation for fishery biology, G. L. KESTEVEN; Some notes on methods used in fishery research, B. B. PARRISH; Age determination of cod by fin rays and otoliths, J. A. GULLAND; Consistency of scale reading, JOHN R. CLARK; Time of formation of scale annuli, ALBERT C. JENSEN and JOHN R. CLARK; Use of otoliths and scales of the Artic haddock, G. SAETERDAL; Otoliths in age determination, G. C. TROUT; Age and growth of redfish (Sebastes marinus L.) ADOLF KOTTHAUS; Notes on the otoliths of S. marinus and S. viviparus, B. RASMUSSEN; Lee's phenomenon of "apparent change in growth-rate" with particular reference to haddock and plaice, R. JONES; A note on Lee's phenomenon in Georges Bank haddock, CLYDE C. TAYLOR; Measurements of meshes of trawl nets, A. VON BRANDT; Measurement of the mesh of nets, ARTHUR E. J. WENT; Differentiation of fish stocks, C. E. LUCAS; Distribution of larval cod in the Western Barents Sea, JOHN CORLETT; The drift of the planktonic stages of fish in the northeast Atlantic and its possible significance to the stocks of commercial fish, J. H. FRASER; Observations on supposed interminglíng or a certain connection between some stocks of boreal and subarctic demersal food fishes of the eastern and western Atlantic, A. VEDEL TANING; causes of the changes in the stocks of some summer spawners, in the southern North Sea-a working hypothesis - H. J. AURICH, Variations in body proportions of redfish from the Gulf of Maine, Nova Scotian Banks and the Grand Banks, GEORGE F. KELLY and T. W. MARTIN; Review of knowledge about the Atlantic halibut, G. ROLLEFSEN.

2830. Fromm, Paul Oliver, and Ezra Paul Reineke. 1956. SOME ASPECTS OF THYROID PHYSIOLOGY IN RAINBOW TROUT. J. Cell. and Comp. Physiol. Vol. 48, No. 3, pp. 393-404; Biol. Abst., Vol. 33, No. 11, Abst. 41404, 1959.

Experiments were conducted at 15°-17°C on hatchery Rainbow trout that were fed a diet which contained 2% iodized salt. A single intraperitoneal injection of 250 uc of radioiodine was found sufficient to completely thyroidectomize Rainbow trout. This was shown by histological examination of the lower jaws of the fish as well as by a much faster output of radioiodine from the head region in thyroidectomized fish. Using a scintillation counter, count rate meter and graphic ammeter the accumulation and output of radioiodine in the head region was determined at constant geometry. Results on intact, unanesthetized trout showed a peak uptake at 48 hours of 60% of the injected dose (10 μc) with an output half-time of 15.5 ±4.0 days. Radiothyroidectomized trout had a peak uptake at 24 hours of 40% of the injected dose (10 μc) with an output half-time of 1.8 ± 0.1 days. The latter must represent non-thyroidal accumulation. Subtraction of the non-thyroidal uptake from that in non-thyroidectomized fish resulted in a peak uptake at 4 days of some 44% of the injected dose. The true output half-time is probably longer than 15.5 days in intact trout. The oxygen consumption of trout fingerlings weighing 3.8 to 6.0 gm was measured using a constant flow apparatus. Intact fish consumed 0.20 ml/gm/hr. and thyroidectomized fish 0.21 ml/gm/hr. The data are not significantly different.

2831. Kuroki, T. 1957. BIOPHYSICAL STUDIES ON THE AUDITORY CHARACTERISTIC OF FISH. I. DIRECTIONAL AUDIBILITY THROUGH ONE LATERAL LINE. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol. 23, No. 7/8, pp. 400-404; Biol. Abst., Vol. 33, No. 11, Abst. 41443, 1959.

When there is a sound source in the elongate direction of body axis, the upper limit of audible frequency is about 7500 cps and the most sensitive frequency is about 160 cps. The influence of the distance from the sound source on the range of audible frequency is negligible. When the sound source is in a vertical direction from the body axis, the influence of distance on the range of audible frequency is considerable. At 1 m the most sensitive frequency is about 710 cps, but at 1000 m the most sensitive one is about 1300 cps. A lower limit of audible frequency was not found. The audible frequency is lower as the sound pressure becomes higher almost independently of the distance between the source and the body. (Author)

2832. Scholander, Per Fredrik, L. van Dam, John Willis Kanwisher, Harold Theodore Hammel, and Malcolm Stephen Gordon. 1957. SUPERCOOLING AND OSMOREGULATION IN ARCTIC FISH. J. Cell. and Comp. Physiol. Vol. 49, No. 1, pp. 5-24; Biol. Abst., Vol. 33, No. 11, Abst. 41716, 1959.

A study has been made of the osmoregulation of fishes and invertebrates living at or near the freez-

ing point of sea water. The bottom of Hebron Fjord in northern Labrador has a water temperature of--1.7° to --1.8°C all year round. Here lives a large population of fishes with a plasma freezing point of --0.9° to --1.0°. They are hence supercooled by--0.7° to --0.8°. When brought to the surface and put in an ice bath at --1.7° most of these fishes freeze and die. In an ice bath of this temperature surface fishes in the summer also freeze and die. Neither deep nor shallow water fishes freeze, however, when kept at the same temperature at the bottom. In supercooled sea water of--3° several species of southern fishes survive without freezing. If the water is seeded they freeze and die almost instantly. Even in water of--1.5° they freeze and die if touched with ice. It was found that seeding would propagate through pieces of fish skin in either direction. Ice will penetrate a UF glass filter with 1-2 eta pores, but not cellophane. Absence of ice seeding is therefore the condition that makes it possible for the bottom fishes to preserve their hypotonic ancestral blood, at the cost, however, of being supercooled. The shallow water fish moving about in the ice in the winter double their osmoconcentration at that time, i.e., until it almost matches the sea water, and are thereby protected against freezing.

2833. Arnoult, J., and J. Spillmann. 1958. ON SOME SPECIAL TECHNIQUES WHICH FACILITATE THE MAINTENANCE AND TRANSPORTATION OF LIVING AQUATIC ANIMALS. (SUR QUELQUES TECHNIQUES ACTUELLES FACILITANT LE CONFINEMENT ET LEETRANSPORT D' ANIMAUX AQUATIQUES VIVANTS.) Bull. Mus. Natl. Hist. Nat. Vol. 30, No. 4, pp. 386-392; Biol. Abst., Vol. 33, No. 12, Abst. 43711, 1959.

To transport living aquatic animals successfully, many different techniques are used. For some fish, an anesthetic such as chloretone may be used. At times, tranquilizers such as chlorpromazine and amobarbital are used. Plastic bags were very successful. A table is presented in which the information is summarized. (M. L. G.)

2834. Kawakami, Tasae, Kaoru Mitsuhashi, and Otohiko Suzuki. 1958. GENERAL THEORY OF FISHERMEN'S CURRENT MEASURING DEVICE, SIOMIITO. Mem. Coll. Agric. Kyoto Univ. Fish. Ser. Special Number 1958, pp. 83-91. Illus; Biol. Abst., Vol. 33, No. 12, Abst. 43721, 1959.

A mathematical paper with practical applications, including proposals for new designs. In Japanese, sio means tidal current, mi, to detect, and ito, fine string. In Japanese coastal purse seining, experifishermen traditionally drop overboard several equal boulders attached to strings of different lengths to detect underwater currents and avoid entanglement of nets. In addition to the conventional siomi-ito, two new types are proposed. (1) "Different string type" for deep currents. At the depth being tested a very thick string intervenes between the end of the fine string and the sinker. (2) "Different sinker type" for determining current direction and velocity at a certain depth when the current varies discontinuously with depth. Here, the strings are equal and the weights are of different size but of equal weight in water. With the conventional, as well as with this new type, the direction and strength of the current are judged by the divergence of the short string or the string with the small sinker, from the long string or the string with the large sinker. In field tests of the siomi-ito against an Ekman-type current meter, agreement using corrected values was within about 13%. (K. B.)

2835. Taylor, F. W. 1959. MEASUREMENT OF FLOW IN A SMALL STREAM. New Zealand Jour. Sci. Vol. 2, No. 1, pp. 41-45. Illus; Biol. Abst., Vol. 33, No. 12, Abst. 43731, 1959.

In connection with a research project at Taita Experimental Station, it was necessary to build a flow meter to measure stream flows ranging from 0·02 to 10 cusecs and recording accurately at low flows. The design, construction, and operation of a suitable flow meter are described. (Auth. summ.)

2836. Nooue, M., and M. Ogura. 1958. THE CHARACTERISTIC BEHAVIORS OF ANCHOVY SHOALS CALLED "RIPPLING" AND "JUMPING" IN TOKYO BAY. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol. 24, No. 5, pp. 317-321; Biol. Abst., Vol. 33, No. 12, Abst. 44099, 1959.

It is a characteristic of anchovies to swim forming a shoal, members of which sometimes jump out of the water and at other times ripple the water surface. This paper describes the conditions fish are jumping or making ripples. (Authors)

2837. Rose, S. Meryl. 1959. FAILURE OF SURVIVAL OF SLOWLY GROWING MEMBERS OF A POPULATION. Science, Vol. 129, No. 3355. p. 1026; Biol. Abst., Vol. 33, No. 12, Abst. 44117, 1959.

Water in which tadpoles or fish have grown inhibits its growth of others of their own kind. Larger animals may completely suppress the growth of smaller ones and may eventually kill them by this waterborne inhibition. Under natural conditions of overproduction only the more rapidly growing would be expected to survive. (Auth. abst.)

2838. Hamon, B. V. 1958. THE EFFECT OF PRESSURE ON THE ELECTRICAL CONDUCTIVITY OF SEA-WATER. Jour. Marine Res. Vol. 16, No. 2, pp. 83-89; Biol. Abst., Vol. 33, No. 12, Abst. 44197, 1959.

Values of the pressure coefficient of the electrical conductivity of sea-water (chlorinity 19.7%) at different temperatures are presented. The pressure coefficients vary from 1.50×10^{-5} decibar^{-1} decibar^{-1} at 0.5°C to 0.82×10^{-5} decibar^{-1} at 19.5°C. The accuracy is estimated to be ±5% The results have been confirmed by tests at sea. (Auth. abst.)

2839. Herrera, Juan. 1958. CLIMATIC DATA OF THE HARBOUR OF CASTELLON AND THERMIC DATA IN RELATION TO FISHING IN 1957. (DATOS CLIMATICOS DEL PUERTO DE CASTELLON Y

TERMICOS DE LAS AGUAS COSTERAS EN RELACION CON LA PESCA EN 1957. Invest. Pesq. Vol. 12, pp. 113-126; Biol. Abst., Vol. 33, No. 12, Abst. 44198, 1959.

Cloudiness, air temperature, atmospheric pressure, wind, rainfall, sea roughness, water level and water surface temperatures were tabulated through 1957. Sardine fishery started in March 27 (surface temperature 15.5°C) and lasted until Dec. 4 (temperature 15.5°C). (R. M.)

2840. Jitts, H. R., and H. Rotschi. 1958. MEASURE BY THE C^{14} METHOD OF THE PHOTO-SYNTHETIC ACTIVITY OF SOME WATER MASSES IN THE SOUTH WEST PACIFIC IN RELATION TO ITS FERTILITY. (MEASURE PAR LA METHODE AU C^{14} DE L'ACTIVITE PHOTO-SYNTHETIQUE DE QUELQUES MASSES D'EAU DU PACIFIQUE SUD-QUEST EN RELATION AVEC L'ETUDE DE LA FERTILITE DE CES MEMES EAUX. Proc. First (UNESCO) Internatl. Conf. Sci. Res. Vol. 4, pp. 607-632. Illus; Biol Abst., Vol. 33, No. 12, Abst. 44200, 1959.

Systematic trials have been made to measure the photosynthetic activity of the different water masses encountered at each occupied station during the cruises 56/4 and 56/5 of the research vessel ORSOM III. To facilitate the interpretation of the results, the variables affecting, directly or indirectly, the fertility of the sea water have also been determined. The photosynthetic activity was measured by the C^{14} method. Samples were taken in duplicate at the surface and at a depth of 25 meters with plastic sampling bottles specially designed to eliminate any disturbance of the phyto-plankton due to mixing and pouring. They were directly treated in the sampling bottles with constant quantities of radio-active carbon in the form of carbonate of known activity. The samples were then placed in an incubation tank in which sea water was circulating and were illuminated by eight 30-watt neon lamps. After four hours, the samples were filtered under vacuum on millipore filters and the pads were then dried and preserved in plastic containers for measurement of their activity in the laboratory. The photosynthetic activity was determined by the difference between the observed activity of the filter pads from the light and dark samples taken at the same depth. The results were expressed in milligramme of carbon fixed /hour/cubic metre. These measurements show a considerable variations in the photosynethetic activity of the water masses encountered, whereas other measurements seem to show, at first sight, a greater homogenetiy in the distribution of the classical variables such as temperature, salinity, dissolved oxygen and inorganic phosphorus. (Auth. abst.)

2481. Miyake, Y. 1958. A STUDY ON THE ORGANIC PRODUCTIVITY AND THE SOLUBILITY PRODUCT OF $CaCO_3$ IN THE OCEAN BY MEANS OF THE RADIOCARBON C_{14}. Proc. First (UNESCO) Internatl. Conf. Sci. Res., Vol. 4, pp. 651-657; Biol. Abst., Vol. 33, No. 12, Abst. 44203, 1959.

E. S. Nielsen introduced a new technique of measurement of marine productivity by means of radiocarbon C^{14}, which is regarded as better than others. The production of coastal waters at 2 places on the seashore in Japan was studied and the determination of C^{14} fixed in phyto-plankton was standardized by measuring ionization current in CO_2 gas with Lauritsen electroscopes. Observations confirmed a diurnal variation in gross production that was linear in relation to solar radiation. Influence of phyto-plankton respiration and the walls of vessels were negligible. In addition, a comparison was made between the C^{14} method and the dissolved O_2 method. Results showed no difference when laboratory comparison was made using Chlorella in fresh water; an essential difference in productivity values was obtained by both methods when coastal waters were used. In order to make the relation between marine productivity and hydrographic conditions clear, C fixation by means of C^{14} and vertical variation of light in the sea were observed aboard an observation ship off the coast of the Kii Peninsula. The rate of organic production decreased with the distance from the shore; productivity increased again to some extent at the boundary of the Kuroshio and its counter current. The solubility product of $CaCO_3$ in the ocean is important from the geological and geochemical point of view, because of a large amount of $CaCO_3$ deposit on the continent and the ocean floor. The radioactive $CaCO_3$ was labelled with C^{14} and the rate of solution in the oceanic water was determined. The solubility product of $CaCO_3$ is 1.2×10^{-6}, the average of values obtained by Revelle and Wattenberg, respectively. It was further found that sea water near the surface was super-saturated with $CaCO_3$. (Auth. abst.)

2842. Askhayev, M. G. 1958. RESULTS OF FISH ACCLIMATIZATION IN THE WATERS OF EASTERN SIBERIA. (RESUL'TATY AKKLIMATIZATSII RYB V VODOEMAKH VOSTOCHNOY SIBIRI.) Rybnoye Khoziaistvo, Vol. 34, No. 1, Jan. 1958, pp. 17-20.

Several years of investigations have shown that the natural and climatic conditions and food supplies of several waters of Eastern Siberia make it possible to conduct fish breeding and acclimatization activities on wide scale. Experiments on reproduction of sturgeon, sterlet, grayling, whitefish, and others, and also acclimatization of new commercial types of fish such as carp and bream were conducted. (A. S.)

2843. Taguchi, Kasaburo. 1957. THE SEASONAL VARIATION OF THE GOOD FISHING AREA OF SALMON AND THE MOVEMENTS OF WATER MASSES IN THE WATERS OF WESTERN NORTH PACIFIC. I. DISTRIBUTION AND MOVEMENT OF WATER MASSES. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol. 22, No. 9, pp. 511-514; Biol. Abst., Vol. 33, No. 12, Abst. 44208, 1959.

During the 1955 season, to determine the movement of good fishing areas for salmon migrating to the waters of the western north Pacific, exploratory fishing and simple oceanographic observations, including water temperature (0.10.25 and 50 m), water

color, and transparency, were carried out every day by 14 research vessels of Nichiro Fisheries Co., Ltd. The branch current of Kuroshio appears off the Gulf of Kamchatka, extends through the south offing of Komandorskii Island during end of May and early June, comes out in the region Lat. 48°N, Long. 172°E in early May, and moves northwestward as shown by the movement of 4°C (0 m) isothermal line. The cold water mass which grows along the coast of Kamchatka, flows south or southeastward on the southern part from Cape Shipunskii, as can be seen with the tongue of 3° C (50 m) isothermal line. The eastern head of this tongue is projected as far as Long. 170°E, Lat. 48°N., in mid-May, but it is compressed to the coast of Kamchatka as the branch current of Kuroshio progresses. The northwestward-flowing branch current of Kuroshio has a wide spread, and comes gradually into the fishing ground from eastward, showing the existence of a westward current. (Auth. abst.)

2844. Westley, R. E. 1957. AN AUTOMATIC WATER SAMPLER FOR MARINE SHORE STATIONS. Proc. Natl. Shellfish. Assoc. Vol. 48, pp. 79-82; Biol. Abst., Vol. 33, No. 12, Abst. 44211, 1959.

An automatic machine was designed which takes hourly samples of natural waters for a week. The machine was housed on shore with a pump located near high tide level and an intake hose buoyed at proper depths. The apparatus is suitable for measurement of salinities, some pollutants, and possibly bacteriological or plankton samples subject to the particular requirements of storage, evaporation and contamination of samples. (Author)

2845. Sorokin, J. I. 1958. THE RESULTS AND PROSPECTS OF USING CARBON-14 FOR A STUDY OF ORGANIC MATTER CYCLE IN WATER BASINS. Proc. First (UNESCO) Internatl. Conf. Sci. Res. Vol. 4, pp. 633-650. Illus; Biol. Abst., Vol. 33, No. 12, Abst. 44221, 1959.

The processes related to the turnover of C lie in the basis of the biological productivity of water reservoirs. Many links of C turnover in water basins are insufficiently studied, because the usual chemical methods are not sensitive enough to reveal the transformations of different forms of living and dead organic matters, or to follow the succession of organic matter in the process of its turnover. A solution of the basic problems of hydrobiology connected with C turnover is possible only with the aid of C^{14}. Due to special properties of this isotope (soft radiation and long half-life period), it is very convenient for such investigations. A method was worked out using C^{14} to determine the 24-hour productivity of phytoplankton synthesis under 1 m^2 of the water surface, without placing vessels in the water body at each station. By this method the annual photosynthesis production in the Rybinsk Water Reservoir was determined and found different in different parts of the reservoir. The total productivity was 408,000 tons of dry organic matter over the whole water reservoir or 125 g of glucose per m^2 of its area per year. The determination of organic matter production due to chemosynthesis showed that this process in water reservoir or 125 g of glucose per m^2 of its area per year. The determination of organic matter production due to chemosynthesis showed that this process in water reservoirs is closely related with anaerobic disintegration of organic matter in the silt deposits, and under certain conditions may attain considerable values. Since in the course of chemosynthesis, an accumulation of a bacterial mass takes place which serves as food for water invertebrates, this process is a substantial trophic factor. It is established that autotrophic bacteria are eaten and assimilated by aquatic invertebrates. Methods were developed using C^{14} to study nutrition of water invertebrates by algae and bacteria which allow to determine quantitatively the amount of assimilated matter. Some data are obtained, using this technique, concerning feeding of Daphnia and Tendipedidae larvae with labelled bacteria and water plants. (Auth. summ.)

2846. Hiyama, Y., T. Kusaka, and Y. Yamashita. 1958. FISHING EFFECT OF A MODEL LIFT NETS, WITH REGARD TO RELATION BETWEEN MESH SIZE AND FISH LENGTH. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol. 24, No. 6/7, pp. 466-468; Biol. Abst., Vol. 33, No. 12, Abst. 44224, 1959.

Using model lift nets, the authors studied the relation between mesh size and fish length. The fish used was Cyprinus carpio, 197 individuals in a tank. Nets used were of mesh sizes 6, 3 and 1.5 cm, and the lifting speeds of the net were 5, 10 and 20 seconds per 88 cm. The results were tabulated. (Authors)

2847. Kodama, Y. 1958. STUDIES ON THE SPECIFIC GROWTH OF FRESHWATER FISHES REFERRING TO THE WEIGHT INCREASE OF INDIVIDUAL AND POPULATION--I. VARIATION OF THE SPECIFIC GROWTH AND THE RELATION BETWEEN THE AVERAGE AND THE INDIVIDUAL SPECIFIC GROWTH BY A SMALL POPULATION OF THE BROWN TROUT (SALMO TRUTTA L.) REARED IN A POND. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol. 24, No. 6/7, pp. 435-440; Biol. Abst., Vol. 33, No. 12, Abst. 44228, 1959.

The author compared the individual and total population growth of 18 brown trout reared in a pond for 2 months. The variation between growth (wt. increase) and length of the fish increases with growth, is more complicated in natural waters than in a confined pond, and was extremely high in a stocked mountain brook. A formula for the relations is set up. (G. G.)

2848. Nakogome, J. 1958. ON THE PERIODICAL CHANGE OF FISHING CONDITIONS AND THE BODY LENGTH OF A WHOLE YEAR AND THE DISTRIBUTION AND MIGRATION OF SWORDFISH OF THE NORTHWESTERN PART OF THE PACIFIC OCEAN. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish. Vol. 24, No. 5, pp. 322-325; Biol. Abst., Vol. 33, No. 12, Abst. 44237, 1959.

The author divides this region into 11 sub-areas. He discusses change in size, movements and recruitment and fishing effort in these sub-areas. (G. G.)

2849. Onodera, K. 1958. ON THE SURVIVAL OF TROUT FINGERLINGS STOCKED IN A MOUNTAIN BROOK.--I. THE ESTIMATION OF SURVIVAL RATE BY OBSERVATION. (In Japanese with English summ.) Bull. Japanese Soc. Sci. Fish., Vol. 24, No. 6/7, pp. 428-434; Biol. Abst., Vol. 33, No. 12, Abst. 44238, 1959.

The number of fingerling trout in a brook were observed by a water glass and these figures compared with estimates made by seining. From these figures a formula was set up by which survival rates after stocking could be determined by visual observation with the water glass. (G. G.)

2850. Scholander, Per Fredrik, and Levie Van Dam. 1956. MICRO-GASOMETRIC DETERMINATION OF OXYGEN IN FISH BLOOD. J. Cell. and Comp. Physiol., Vol. 48, No. 3, pp. 529-532; Biol. Abst., Vol. 33, No. 12, Abst. 44262, 1959.

A micro-gasometric method is described using the SR syringe analyzer, which permits oxygen analysis in bloods that normally cannot be analyzed by the method of Roughton and Scholander, such as, for instance, cat and fish blood.

2851. Halver, John E. 1957. NUTRITION OF SALMONOID FISHES. IV. AN AMINO ACID TEST DIET FOR CHINOOK SALMON. J. Nutrition, Vol. 62, No. 2, pp. 245-254; Biol. Abst., Vol. 33, No. 12, Abst. 44566, 1959.

An amino acid test diet for chinook salmon (Oncorhynchus tschawytscha) was developed which contained (in %) L-amino acid mix 35, carboxymethylcellulose 5, dextrin 3, corn oil 2.5, minerals 2, alpha cellulose vitamins 1.5, cod liver oil 1, and water 50. The level of each crystalline L- amino acid in the test diet was (in %) arginine, HCl 2.5, methionine 1, phenylalaine 2, threonine 1.25, tryptophan 0.5, valine 2, alanine 1.75, aspartic acid 2.5, cystine 0.25, glutamic acid 4, glycine 2.5, proline 2.5, serine 1.5, and tyrosine 2. The diet was prepared by adding all the dry ingredients except carboxymethylcellulose to warm water, blending thoroughly in a mechanical mixer, adding the carboxymethylcellulose and mixing to the desired consistency. The diet could be prepared as a floating or sinking diet was tested for 14 weeks and comparisons with a complete vitamin test diet indicated no significant differences in growth or mortality. By deleting the amino acids one at a time from this diet, it would be possible to classify the indispensable amino acids for chinook salmon.

2852. Anonymous. 1959. PROGRESS REPORT ON ALASKA FISHERY MANAGEMENT AND RESEARCH, 1958. U. S. Fish and Wildlife Service Special Scientific Report--Fisheries, No. 294, 28 pgs.

2853. Yamamoto, Toki-o. 1958. ARTIFICIAL INDUCTION OF FUNCTIONAL SEX-REVERSAL IN GENOTYPIC FEMALES OF THE MEDAKA (ORYZIAS LATIPES J. Exp. Zool. Vol. 137, No. 2, pp. 227- 264. Biol. Abst.; Vol. 33, No. 12, Abst. 45104, 1959.

Using a genetically analyzed fish breed (the medaka, Oryzias latipes), methyl testostone is administered per os beginning with the stage of indifferent gonad and continuing through the period of gonadal sex-differentiation, after which treated fish are reared on normal diet to full growth. sex-linked R (orange-red) and r (white) characters are used as markers of the sex-chromosomes in order to distinguish the sex geno-type. Methyl testosterone exerts a suppression of gonadogenesis irrespective of the sex genotype, and induces reversal of gonadal sex-differentiation in genetic females (X^rX^r). The range of adequate dosage levels is found to be narrow and testes are usually atypical in form. No paradoxical feminization is observed in any treated groups. With high-level dosages, fry of either genetic sex (X^rY^R) first differentiate into males with rudimentary testis eventually becoming neuter (sexless) in full-grown fish. With moderate and lower dosages, so far 95 mature sex-reversal males and three intersexes of the female genotype (X^rX^r) are obtained. The majority of sex-reversals (X^rX^r) induced by adequate dosages are fertile while the rest are proved sterile in mating only, having a testis which contains fecund spermatozoa, as is proved in artificial fertilization. Twenty-seven sex-reversal males crossed separately with normal females (X^rX^r) produced all-female F_1 progenies, a total of 1,376. In genetic behavior, the F_1 white daughters of sex-reversals are the same as normal white females.

2854. Mahon, Elizabeth Florence, and William S. Hoar. 1956. THE EARLY DEVELOPMENT OF THE CHUM SALMON ONCORHYNCHUS KETA (WALBAUM). J. Morph., Vol. 98, No. 1, pp. 1-48. Biol. Abst., Vol. 33, No. 12, Abst. 45743, 1959.

Development of Oncorhynchus keta, the chum salmon, is traced from appearance of 1st cleavage furrow (approximately 14 hours, 20 minutes after fertilization at 8.2°C) to closure of blastopore when embryo measures 6.0 mm in length. Early cleavage, Blastulation; dorsal lip formation and laying down of germ layers are described. Development is traced in the following stages: 1.5 mm embryo (formation of neural keel, notochord, Kupffer's vesicle), 2 mm embryo (anlage of forebrain, optic vesicles, mesoderm), 3 mm embryo (development of neural crests, pha-pouches), 3.5 embryo (optic vesicles, auditory anlagen, heart rudiment, gut), 4 mm embryo (lens placode, intermediate cell mass, lateral plates), 5 mm embryo (differentiation of brain, optic cups, infundibulum, blood vessels, pronephros, segmental duct), 6 mm embryo (olfactory placode, hypophysis, glomerulus, blood islands). Two features are more fully discussed: (1) The large vesicular type of nuclei in the telophase of early cleavage stages; (2) the occurrence to two types of enlarged cells, one which hypertropies and degenerates and the other which may be a primary primordial cell.

2855. Marckmann, K. 1958. THE INFLUENCE

OF THE TEMPERATURE ON THE RESPIRATORY METABOLISM DURING THE DEVELOPMENT OF THE SEA-TROUT. Meddel. Danmarks Fisk-og Havundersog. Ny Ser. Vol. 2, No. 21, pp. 1-20; Biol. Abst., Vol. 33, No. 12, Abst. 45772, 1959.

Posthumous publication of experiments initiated by Marckmann and completed by J. Boetius to determine the respiratory metabolism (O_2 consumption) of sea-trout during development from fertilized egg to about 800 day degrees at different, constant temperature and to expose the developing animals to sudden alterations of temperature between 140 and 160 day degrees to see whether the metabolism had been altered, after return to the initial temperature. Four constant temperatures were selected: 3°, 6°, 9°, and 12°C. O_2 consumption was determined by Winkler's method, using 10 embryos together. The respiratory rate rises steadily during development, reaching at hatching, a value about 20 times greater than at fertilization. After hatching, there is steep rise, but from about 600 day degrees the respiratory rate remains fairly constant at a value about 300 times that of the newly-fertilized egg. At stages of more than 250 day degrees, the respiratory metabolism shows a minium at temperatures around 6°C. This result is particularly interesting because sea-trout reared at this temperature have a minimum number of vertebrae, maxium body weight (at about 850 day degrees) and maximum incubation time. Sudden temporary alternations of temperature during the period 140-160 day degrees cause no demonstrable changes in the metabolism when the temperature change takes place within the interval 3-9°C. Outside this interval even small temporary temperature alterations may bring about considerable changes in the metabolism none of the changes in metabolism produced by shock treatment assume a permanent character when the eggs were returned to the initial temperature. A permanent temperature alteration can cause a radical change in metabolism; at about 300 day degrees a change from 9°C to 3°C caused a delay of about 45 day degrees in comparison to the animals, the whole development of which took place at 3°C. (D. V. E.)

2856. Fitch, John E. 1958. OFFSHORE FISHES OF CALIFORNIA. State of California, Department of Fish and Game: Sacramento. 80p. Illus. pr. $0.35; Biol. Abst. Vol., 33, No. 12, Abst. 47422, 1959.

Included in a 14-page introductory portion are short general sections on geologic history, numerical abundance, classification, natural history and management of marine fishes. More specific information on distinguishing characteristics, distribution, life history, fishery and use is detailed for 27 of the more important species of marine fishes caught offshore from California. Each of these 27 species is illustrated. They include: Alopias vulpinus, Prionace glauca, Oncorhynchus tschawytscha, O. kisutch, Citharichthys sordidus, Paralichythys californicus, Stereolepis gigas, Paralabrax clath clathratus, Sphyraena argentea, Seriola dorsalis, Trachurus symmetricus, Pneumatophorus diego, Sarda chiliensis, Thunnus saliens, T. germo, Makaira audax, Cynoscion nobilis, Genyonemus lineatus, Caulolatilus princeps, Pimelometopon pulchrum, Sebastodes paucispinis, S. serranoides, S. mystinus, S. miniatus, Scorpaena guttata, Anoplopoma fimbria and Ophiodon elongatus. (Author)

2857. Kurogane, K., and Y. Hiyama. 1958. MORPHOMETRIC COMPARISON OF THE YELLOWFIN TUNA FROM SIX GROUNDS IN THE INDIAN OCEAN. Bull. Japanese Soc. Sci. Fish. Vol. 24, No. 6/7, pp. 487-494; Biol. Abst., Vol. 33, No. 12, Abst. 47434, 1959.

The authors measured 16 morphometric characters of 2750 fish from 6 separate grounds in the Indian Ocean. Covariance analyses showed that yellowfin tuna in the Lesser Sunda area are distinctly separated from populations of the Equatorial Indian Ocean, and that the latter fish are somewhat separable from the east and west, with some commingling. (G. G.)

2858. Slastenenko, E. P. 1958. THE FRESHWATER FISHES OF CANADA. 385p. Illus. Map. Kiev Printers; Biol. Abst. Vol. 33, No. 12, Abst. 47443, 1959.

This book contains a detailed description and identification tables for 185 native and introduced species included in 87 genera and 27 families; and includes synonymy, taxonomy, distribution, and general information on size, habitat, food habits and commercial value. Growth rates are illustrated for some of the more important fish. There are keys to the families, genera, and species; a glossary, references, index to scientific and common names, and a distributional summary in tabular form.

2859. Buss, Keen. 1959. TROUT AND TROUT HATCHERIES OF THE FUTURE. Transactions of the American Fisheries Society. Vol. 88, No. 2, pp. 75-80.

Possible and probable methods for improvement of fish hatchery management and production of trout are presented. It is concluded that in the future application of known information and further research will result in more efficient and more mechanized fish rearing and distribution; in better diets and feeding methods; in improvements in disease control; and in development of improved strains of fish. The literature on these topics is reviewed. (Auth. abst.)

2860. White, C. E., Jr. 1959. SELECTIVITY AND EFFECTIVENESS OF CERTAIN TYPES OF COMMERCIAL NETS IN THE T. V. A. LAKES OF ALABAMA. Transactions of the American Fisheries Society. Vol. 88, No. 2, pp. 81-87.

Trammel, riprap and gill nets with nylon webbing of 3-, 3.5- and 4-inch bar measure were fished under supervision by commercial fishermen in the T. V. A. lakes of Alabama to determine effectiveness of such nets for taking rough fish. Several types of sets were used of which the whip-set trammel was most effective followed by the fixed trammel, riprap and gill net. Mesh of 3-inch bar measure was gener-

ally most efficient for taking rough fish. During the period November, 1955, through May, 1956, 10,425 fish weighing 42,689 pounds were taken in the several kinds of gear and of these 95.4 percent were rough fish. (Auth. abst.)

2861. Katz, Max, Austin Pritchard, and Charles E. Warren. 1959. ABILITY OF SOME SALMONIDS AND A CENTRARCHID TO SWIM IN WATER OF REDUCED OXYGEN CONTENT. Transactions of the American Fisheries Society. Vol. 88, No. 2, pp. 88-95.

An apparatus was constructed to determine the ability of fish to swim against currents of known velocity in water of various dissolved oxygen content for periods of one or two days. Fish were tested in currents of 0.8 and 1.2 feet per second at dissolved oxygen concentrations of two milligrams per liter and higher. The ability of juvenile chinook salmon (Oncorhynchus tshawytscha) to resist the above currents is in part dependent on their size. Only chinooks over fifty millimeters in total length were able to swim for a day against a current of 1.2 feet per second in water with dissolved oxygen content near the saturation value. In water with a mean dissolved oxygen concentration of 3.0 miligrams per liter or greater in all expeiments but one, juvenile chinook salmon were able to swim for at least one day against a current of 0.8 foot per second. In all tests at mean oxygen concentrations less than 2.84 milligrams per liter, some fish were unable to swim for the one-day period. In experiments at mean dissolved oxygen concentrations above 2.95 milligrams per liter, all juvenile coho salmon (Oncorhynchus kisutch) were able to swim against a current of 0.8 foot per second for two days. At oxygen levels between 2.0 and 2.7 millgrams per liter, some of the juvenile cohos were able to swim for two days. Largemouth bass (Micropterus salmoides) during September were able to swim against a current of 0.8 foot per second for one day at °C. in water having a mean dissolved oxygen content of 2.0 milligrams per liter. In early December, at temperatures of from 15.5 to 17 C., through the bass could swim against the 0.8 foot per second current when the water was nearly saturated with dissolved oxygen, they were unable to do so by the time the oxygen was reduced to 5.0 milligrams per liter. (Auth. abst.)

2862. Hoffman, Glenn L. 1959. STUDIES ON THE LIFE CYCLE OF APATEMON GRACILIS PELLUCIDUS (YAMAG.) Transactions of the American Fisheries Society. Vol. 88, No. 2, pp. 96-99.

A tetracotyliform metacercaria was found in the musculature of the brook stickleback (Eucalia inconstans). It is characterized by a tail-like appendage on the cyst. The adult was reared in newly hatched chicks, and proved to be Apatemon gracilis pellucidus (Yamaguti, 1933). Attempts to infect snails; Physa, Stagnicola and Helisoma, were unsuccessful. (Auth. abst.)

2863. Schaefer, Milner B. 1959. BIOLOGICAL AND ECONOMIC ASPECTS OF THE MANAGEMENT OF COMMERCIAL MARINE FISHERIES. Transactions of the American Fisheries Society. Vol. 88, No. 2, pp. 100-104.

Conservation management of the commercial marine fisheries has the general objective of maximizing man's long-term benefits from the exploitation of the fish resources. The question of what is most beneficial to man involves both biological and economic considerations. In this paper some of the effects of fishing on the fish stocks, and on the sustainable yields from them, are considered, together with important economic factors. It is indicated that the maximum sustainable average catch and the maximum net economic yield are mutually exclusive. It is possible, however, to obtain some net economic yield at the level of maximum sustainable harvest, but this requires some modification of the common property nature of fish stocks. (Auth. abst.)

2864. McHugh, J. L. 1959. CAN WE MANAGE OUR ATLANTIC COASTAL FISHERY RESOURCES? Transactions of the American Fisheries Society. Vol. 88, No. 2, pp. 105-110.

A fresh approach to coastal fisheries problems is needed; one including more biological and educational work and investigation of economic, social, and political factors which are potent influences in the interaction of fisheries resources and man. The conventional approach, by methods designed to foster management for optimum sustained yield for each important species, holds little promise for management of migratory fishes in inshore waters of the Atlantic coast. More consideration should be given to management of the biomass of the entire resource. Some statistics of the Atlantic coast fisheries are given and promising approaches for bettering management discussed. (Auth. abst.)

2865. Surber, Eugene W. 1959. CRICOTOPUS BICINCTUS, A MIDGEFLY RESISTANT TO ELECTROPLATING WASTES. Transactions of the American Fisheries Society. Vol. 88, No. 2, pp. 111-116.

In polluted stretches of Michigan rivers, larvae of the midgefly, Cricotopus bicinctus (Meigen), were found to be particularly resistant to electroplating wastes containing hexavalent chromium, cyanides, and copper and to low oxygen levels. This insect survived in the Clinton River and matured in concentrations of chromium as great as 25 p.p.m., copper to 2.2 p.p.m. and cyanides to 3.2 p.p.m. In waters receiving such plating wastes, the only other common bottom invertebrates were the annelids, Limnodrilus and Tubifex, and a midge tentatively identified as a species of Pentapedilum. (Auth. abst.)

2866. Wolf, Ken, and C. E. Dunbar. 1959. TEST OF 34 THERAPEUTIC AGENTS FOR CONTROL OF KIDNEY DISEASE IN TROUT. Transactions of the American Fisheries Society. Vol. 88, No. 2, pp. 117-124.

Sixteen strains of fish kidney disease bacterium were tested in vitro to determine their reaction to 34 therapeutic agents. On the basis of the results obtained ten of the drugs were employed in experimental therapy of kidney disease in eastern brook trout (Salvelinus fontinalis). Erythromycin at the

rate of 100 milligrams per kilogram of fish per day (4.5 grams per 100 pounds of fish) for 21 days gave the best results. Other drugs gave only temporary benefit if any. (Auths. abst.)

2867. Williams, Wells E. 1959. FOOD CONVERSION AND GROWTH RATES FOR LARGEMOUTH AND SMALLMOUTH BASS IN LABORATORY AQUARIA. Transactions of the American Fisheries Society. Vol. 88, No. 2, pp. 125-127.

A laboratory and feeding experiment measuring the food conversion and growth rates of five largemouth bass (Micropterus salmoides) ranging in length from 117 to 312 millimeters (4.6 to 12.3 inches) and sixteen smallmouth bass (Micropterus dolomieu) ranging in length from 83 to 202 millimeters (3.3 to 7.9 inches) gave average food conversion values of 4.5 for the smallmouth bass, and 3.8 for the largemouth bass when an excess of small, live fish were fed, and average aquarium temperature was 70.3 degrees F. Individual bass consumed from 2.5 to 13.3 percent of their initial body weight daily, with highest consumption usually by the smaller bass. average daily increase in weight in proportion to initial weight varied considerably, but was also greatest for the smaller fish. (Auth. abst.)

2868. Haley, A. James, and Howard E. Winn. 1959. OBSERVATIONS ON A LERNAEAN PARASITE OF FRESHWATER FISHES. Transactions of the American Fisheries Society. Vol. 88, No. 2, pp. 128-129.

An examination of fish collected from Smith Pond, College Park, Maryland in July, 1957 revealed that several species were heavily infected with the parasitic copepod, Lernaea cyprinacea Linnaeus. Additional collections were made throughout the summer and early fall in order to ascertain the host distribution of the parasite, and the incidence and intensity of infection. The purpose of this paper is to report the results of this survey, as well as some preliminary observations on the life history of the parasite and gross pathology of the infection. (Auths. abst.)

2869. Iversen, Edwin S., and Raymond B. Manning. 1959. A NEW MICROSPORIDAN PARASITE FROM THE PINK SHRIMP (PENAEUS DUORARUM). Transactions of the American Fisheries Society. Vol. 88, No. 2, pp. 130-132.

A new species of microsporidian (sporozoan) parasite in the musculature of the pink shrimp Penaeus duorarum from three locations in south Florida is described. The name Thelohania duorara n. sp. is suggested for this parasite which causes a milky white color in pink shrimp. The ovoid spores measured 5.4 by 3.6 microns and had a polar filament of uniform diameter and 38 microns in length. (Auths. abst.)

2870. Phillips, Authur M., Jr. 1959. THE KNOWN AND POSSIBLE ROLE OF MINERALS IN TROUT NUTRITION AND PHYSIOLOGY. Transaction of the American Fisheries Society. Vol. 88, No. 2, pp. 133-135.

The known role of minerals in trout nutrition and physiology are discussed. It is pointed out that dissolved minerals in the water play an important part in the normal metabolism of the fish. A knowledge of mineral metabolism in higher animals has resulted in the rearing of more vigorous and healthy animals and the accumulation of such knowledge for fish should provide a sounder basis for both the rearing of hatchery fish and the management of natural waters. (Auth. abst.)

2871. Parsons, John W. 1959. MUSKELLUNGE IN TENNESSEE STREAMS. Transactions of the American Fisheries Society. Vol. 88, No. 2, pp.136-140.

Muskellunge (Esox masquinongy) are known to inhabit 169 miles of rocky and fast-flowing streams on the Cumberland Plateau in East-Central Tennessee. These waters are usually clear (turbidity less than 5 p.p.m.) and slightly acid. Muskellunge in Tennessee streams grow an average of 5.8 inches per year but few fish live beyond 6 years of age. Male fish mature when about 22 inches long and 3 years old; females mature when about 25 inches long and 3 or 4 years old. Muskellunge spawn in April when water temperatures are near 50°F. Young fish are found in only 15 percent of the total habitat distance. Management of the muskellunge streams in Tennessee appears to be necessary to maintain the presently small muskellunge fishery. (Auth. abst.)

2872. Smith, Lloyd L., Jr., Donald R. Franklin, and Robert H. Kramer. 1959. ELECTRO-FISHING FOR SMALL FISH IN LAKES. Transactions of the American Fisheries Society. Vol. 88, No. 2, pp. 141-146.

An electric seine for use on small fish in shallow water was designed to use interrupted direct current from a 2,500-watt direct current portable generator. An electronic circuit activated a relay in the seine supply circuit. A square wave with duty cycle of 0.50 to 0.90 was formed at frequencies of 20 to 300 per minute. Tests made in a webbing enclosure in a lake showed 240-interruptions per minute at 230 volts was most effective for catching fish. The seine was boat-mounted and embodied a double row of vertical electrodes. Electrotactic response was low but the seine is satisfactory if efficiency levels can be determined for water quality, orientation of operation, and other variables encountered in normal field work. (Auths. abst.)

2873. Williams, Walter R. 1959. THE FISHERY FOR HERRING (CLUPEA PALLASII) ON PUGET SOUND. Fisheries Research Papers. Washington Department of Fisheries. Vol. 2, No. 2, pp. 5-30.

Herring spawn in Puget Sound from late December to the middle of May, although the peak of spawning occurs during late February, March, and early April. Spawning stocks are comprised of 2- to 7-year-old fish with only occasional specimens reaching 10 years of age.

The average annual production for Puget Sound from 1935 to 1955 has approximated 600,000 pounds,

ranging from a low catch of 72,570 pounds in 1942 to a maximum of 1,195,544 pounds in 1947. Annual production by areas since 1935 indicates a very sporadic fishery with wide fluctuations within areas. Seasonal fishing is conducted in all in-sound areas except Tacoma-Wollochet where the fishery fluorishes the year round with the heaviest intensity occuring during June and July. The southern fishery was of minor importance in comparison to the total Puget Sound production until 1949, but since that time the landings steadily increased until by 1954 it was producing the largest portion in Puget Sound.

Sampling has shown that the oncoming zero year class herring enter the fishery in August at approximately $3\frac{1}{2}$ inches long and largely support the bait fishery from August until the following March.

Formerly depleted stocks, such as those spawning in Discovery Bay, Hale Passage and Birch Bay, have regained their productive levels after many years without exploitation. Holmes Harbour, Keyport, and Hood Canal contain the only spawning stocks that have been fished in recent years. Spawning ground surveys conducted in 1955 indicated that these stocks had extensive spawnings over a longer period of time than normally occurs. Egg depositions in other areas were from light to medium.

An analysis of the age of the spawning stocks was conducted to measure the effect of the intensified fishery on the small immature herring. The percentage of 2-year-olds of any given class does not appear to bear any relationship to the percentage of 5-year-olds that will appear the following year. For Puget Sound stocks of herring the age analysis suggests further that recruitment is adequate, providing the combined percentage of 2- and 3-year-olds comprise 50 percent of the spawning stock. The percentage age compositions for the past 3 years shows no indication that recruitment has been hindered due to the intensified fishery on the juvenile herring. (Auth. summ.)

2874. Schoeneman, Dale E. 1959. SURVIVAL OF DOWNSTREAM MIGRANT SALMON PASSING ALDER DAM IN AN OPEN FLUME. Fisheries Research Papers. Washington Department of Fisheries. Vol. 2, No. 2, pp. 30-37.

It may be concluded, therefore, that transporting downstream migrant fish from a forebay collecting device to tailwater by means of an open flume does not create damage to fish serious enough to cause death. However, as the tests herein described could not involve assessment of possible predation of fish stunned or confused by their being catapulted into tailwater has not been possible. Based on these facts the minimum survival to be expected (except for possible predation loss) is not less than 97 percent in the flume and drop, and the survival in all probability will be closer to 100 percent. The differences in survival between a level and an elevated discharge flow were not great enough to measure. The volume of water flowing down the flume (within the limits tested) seems to have little, if any, effect on survival. (Auth. Concl.)

2875. Hickman, Cleveland P. Jr. 1959. THE LARVAL DEVELOPMENT OF THE SAND SOLE (PSETTICHTHYS MELANOSTICTUS). Fisheries Research Papers. Washington Department of Fisheries. Vol. 2, No. 2, pp. 38-47.

In Puget Sound, the pelagic eggs of the sand sole are locally abundant in surface waters from January through March. Eggs of this species are about one millimeter in diameter and are essentially indistinguishable from those of the English sole, Parophrys vetulus, and the starry flounder, Platichthys stellatus, until the inception of embryonic pigmentation. The color and distribution of cell pigments of the sand sole larvae are unique among the flatfishes found in Puget Sound and serve to distinguish the larvae throughout their development. During the yolk-sac stage, the larvae are characterized by a distinctive brown color and the pattern of the fin fold melanophores. At about 4.5 mm. total length and after disappearance of the yolk-sac, a conspicuous orange pigment appears in a group of chromatophores delineating the posterior edge of the coelom and in certain myotomic chromatophore groups along the dorsal and anal fin insertions. These orange pigment cells remain until metamorphosis to the definitive body form (22-25 mm.) Formation of fin rays, beginning at 9 mm., is essentially complete in the 15 mm. larva; dextral migration of the left eye is complete at 22 mm. (Auth. summ.)

2876. Rees, William H. 1959. EFFECTS OF STREAM DREDGING ON YOUNG SILVER SALMON (ONCORHYNCHUS KISUTCH) AND BOTTOM FAUNA. Fisheries Research Papers. Washington Department of Fisheries. Vol. 2, No. 2, pp. 53-65.

A program was begun in July, 1952 and terminated in August, 1953 to measure the effects of dredging and stream channeling on fish and bottom organisms in Little Bear Creek, a small stream populated by silver salmon and a tributary to the Sammamish River 15 miles northeast of Seattle.

Random bottom samples were taken periodically in test and control areas to measure population changes in food organisms. Dredging in September, 1952 eliminated 97 percent of the bottom organisms in the test area. The dredged area showed a reduced fauna' population for 5 months and then began to recover in February, 1953. By July, 1953 it had recovered completely.

A predominance of dipterous larvae over the other bottom organisms was found in the stomach contents of young silver salmon, even during periods of low dipterous production.

Population estimates of zero group silver salmon and trout fingerlings showed a decrease of 69 percent and 81 percent respectively immediately after dredging in September, 1952. Fish were killed by the drag line or by being trapped in the various isolated sections of the old channel. Changing of the stream bed also caused indirect effects such as destruction of the food supply and elimination of suitable living area. Population estimates made a year later (August, 1953) compared favorably in test and control areas with estimates made during August, 1952.

The relationship of waterflow (velocity) and bottom type to organism type indicated that Diptera predominate in slow, sandy bottom areas. Coleoptera preferred moderate velocity with sand and gravel, and Ephemeroptera, Plecoptera, and Trichoptera all preferred swift flow and gravel bottom. (Auth. summ.)

2877. Wendler, Henry O. 1959. MIGRATION AND FISHING MORTALITY RATES OF COLUMBIA RIVER SPRING CHINOOK SALMON IN 1955. Fisheries Research Papers. Washington Department of Fisheries. Vol. 2, No. 2, pp. 71-81.

A total of 1,482 chinook salmon was tagged in the Columbia River near Astoria, Oregon, during the period from January 12 to April 25, 1955. Of the subsequent 504 recoveries, the Columbia River commercial fishery accounted for 413; the Columbia River basin sport fisheries, 57; hatchery operations and nearby spawning grounds, 31; and 3 were returned from the ocean troll fishery. Returns of tagged fish indicated that the Willamette and Klickitat rivers had runs that passed through the lower Columbia River relatively early and for all practical purposes did not enter the commercial fishery in 1955.

The average delay of fish at the mouth of the river was computed by two independent methods and found to be 26 and 33 days respectively. The rate of migration after delay was estimated to be 8 to 10 miles per day.

The size composition of tagged fish and commercial recoveries were similar, but comparison with the size composition from other years indicated dissimilar modal strength.

Fishing mortality on the total run was calculated to be 82.7 percent when computed by tag returns. On the other hand, mortality calculated from catch data and fish counts at Bonneville dam was computed to be 79.1 percent. Corresponding estimates of the below-Bonneville exploitation rate were 41.4 and 39.6 respectively. The low water conditions evidenced in Zone 6 permitted a longer period of fishing and was instrumental in the high percent catch realized in 1955. (Auth. summ.)

2878. Thompson, Richard B. 1959. A STUDY OF LOCALIZED PREDATION ON MARKED CHINOOK SALMON FINGERLINGS RELEASED AT McNARY DAM. Fisheries Research Papers. Washington Department of Fisheries. Vol. 2, No. 2, pp. 82-83.

The results of this study indicated that predation was too slight to bias dam mortality test results.

2879. Ellis, C. H. and R. E. Noble. 1959. CALCULATED MINIMUM CONTRIBUTIONS OF WASHINGTON'S HATCHERY RELEASES TO THE CATCH OF SALMON ON THE PACIFIC COAST AND THE COSTS ASSESSABLE TO HATCHERY OPERATIONS. Fisheries Research Papers. Washington Department of Fisheries. Vol. 2, No. 2, pp. 88-99.

From extensive data collected by the Washington Department of Fisheries, including ten-year summaries of hatchery fish survivals, calculations have been made which give the expected contributions made to salmon production along the Pacific Coast by plants from Washington hatcheries. This contribution to the Pacific Coast production of salmon is an integral and significant part of the economy of the fishing industry which ranges from California to Alaska.

From one year's hatchery liberations of reared salmon by Washington State, it has been calculated that there will result a production of 574,580 salmon worth $2,358,729 in catch value alone, produced at a total cost of $926,016. The resultant cost to catch value ratio would therefore amount to 1 to 2.5 for Washington State. (Auth. summ.)

2880. Black, Edgar C., Wing-Gay Chiu, Francis D. Forbes and Arthur Hanslip. 1959. CHANGES IN pH, CARBONATE AND LACTATE OF THE BLOOD OF YEARLING KAMLOOPS TROUT, SALMO GAIRDNERI, DURING AND FOLLOWING SEVERE MUSCULAR ACTIVITY. Journal of the Fisheries Research Board of Canada. Vol. 16, No. 4, pp. 391-402.

Alterations in the blood levels of lactate, carbonate, hydrogen ion and hemoglobin following vigorous muscular exercise were studied in yearling Kamloops trout, Salmo gairdneri, over four years.

Lactate increased during exercise and during the first 2 hours of rest, returning to the initial level after 6 to 8 hours. Carbonate increased to a maximum during the first 3 minutes of exercise, then dropped precipitously to a minimum far below the initial level after $\frac{1}{2}$ hour of rest, later rose to near the initial level at the 4th hour of recovery, maintained this until the 12th hour, but it had decreased again at the 24th hour. Hydrogen ion concentration rose sharply during the first 3 minutes of activity, then fell off to a stable level a little above the initial figure until the end of exercise, after which it fell substantially below initial level and had not completely recovered after 27 hours of rest. A marked decrease in swimming rate occurred after 3 minutes exercise, following the initial rise of carbonate and hydrogen ion concentration. (Auths. abst.)

2881. Grainger E. H., and J. G. Hunter. 1959. STATION LIST OF THE 1955-58 FIELD INVESTIGATIONS OF THE ARCTIC UNIT OF THE FISHERIES RESEARCH BOARD OF CANADA. "CALANUS" SERIES NO. 19. Journal of the Fisheries Research Board of Canada. Vol. 16, No. 4, pp. 403-420.

A list is given of 18 stations where marine biological, oceanographic and fishing observations or collections were made by the Calanus and land-based investigations of the Arctic Unit between Labrador and the Yukon-Alaska boundary from 1955 to 1958. (Auths. abst.)

2882. Creelman, Vera M., and Neil Tomlinson. 1959. BIOCHEMICAL STUDIES ON SOCKEYE SALMON DURING SPAWNING MIGRATION. VI. RIBONUCLEIC ACID AND DEOXYRIBONUCLEIC ACID. Journal of the Fisheries Research Board of Canada. Vol. 16, No. 4, pp. 421-428.

The quantity of ribonucleic acid phosporus (RNA-P) and deoxyribonucleic acid phosphorus (DNA-P) in

various tissues of the sockeye salmon has been determined at three points in its spawning migration. During migration a net decrease in RNA-P and a net increase in DNA-P occurred in the whole fish of both sexes. Major losses in RNA-P occurred in the flesh, alimentary tract and milt, while major gains in DNA-P occurred in the milt and roe. In the combined head, skin, bones and tail large gains in both RNA-P and DNA-P took place. (Auths. abst.)

2883. Parker, R. R, E. C. Black and P. A. Larkin. 1959. FATIGUE AND MORTALITY IN TROLL-CAUGHT PACIFIC SALMON (ONCORHYNCHUS). Journal of the Fisheries Research Board of Canada. Vol. 16, No. 4, pp. 429-448.

Capture by trolling subjects feeding coho and chinook salmon to hyperactivity which may lead to a distressed condition or death, and death cannot be predicted from examination of individual fish at time of capture. Mortality of coho was estimated to be in the 0.95 confidence interval of 34% and 52%. Time of maximum death rate of coho is shown to coincide with the period of maximum blood lactate response. Survival occurred either when blood lactate did not reach critical levels (Above 125 mg%) or reached critical levels and subsequently subsided. Holding salmon in a live box for 8-14 hours before release did not improve tag recovery, suggesting additional indiscriminant stress was caused at release. Adult coho in fresh water did not appear capable of lethal hyperactivity. This led to the hypothesis that cessation of feeding during spawning migration has adaptive significance for survivial of Pacific salmon. (Auths. abst.)

2884. Grainger, E. H. 1959. THE ANNUAL OCEANOGRAPHIC CYCLE AT IGLOOSLIK IN THE CANADIAN ARCTIC. I. THE ZOOPLANKTON AND PHYSICAL AND CHEMICAL OBSERVATIONS. CALANUS SERIES, No. 20. Journal of the Fisheries Research Board of Canada. Vol. 16, No. 4, pp. 453-501.

Materials used were collected September 1955 to September 1956 near Igloolik, northwest Foxe Basin, in the Canadian arctic. A single station, about one mile from shore and 52 m deep, was occupied 27 times during the year. It is in a region of net flow of arctic water from Fury and Hecla Strait, whose strong current probably brings ever-changing hydrographic conditions and plankton populations to the station area. Sea ice formed in early November and had thickened to about 152 cm by early May. Melting then began and continued until the station was free of fast ice soon after mid-July. Water temperatures varied only 3.55°C at all depths during the year, and only 0.07° from November until May. The coldest record was -1.75° at 50 m in April and May, the warmest 1.80° at the surface in early September. Salinities varied from a maximum of 32.59‰ in early May to less than 1.68‰ at the surface in mid-July. A thin layer of brackish water, probably not exceeding 2 m in depth, was developed at the surface during the ice-melting period from late June until early August. Dissolved oxygen content varied from 9.52 ml/l in early July to 4.08 ml/l in early September. The maximum saturation recorded was 110.3% at 10 m on July 15. Dissolved inorganic phosphate rose from near zero in February to a maximum of 1.5 µg-at/l in mid-June, then declines until autumn.

Zooplankton volume (from the coarse net) was greatest in late September (4.85 ml per 50-m haul), least in mid-April (0.15 ml). Among identifiable material, copepods were volumetically the largest group. Twenty-eight species were identified, the most numerous forms being copepods (Pseudocalanus minutus, Calanus finmarchicus, C. hyperboreus, Oithona similis), chaetognaths (Sagitta elegans), cirriped larvae, medusae (Halitholus cirratus) and larvaceans (Fritillaria borealis). Several of the more abundant species provide life-history information. All the plankton species has previously been collected in the arctic, and all are circumpolar (one possible exception).

Propagation times of primarily herbivorus plankters coincide with the abundance of their phytoplankton food, and the numerical cycle of these individuals during the year shows a restricted period of maximum numbers during the time of reproduction (summer) followed by gradual decline until late Winter. In contrast, the primarily carnivorous plankters show relatively slight numerical variation throughout the year, and no concentrated period of reproduction. These species reproduce at various times of the year, many of them during winter. A rough estimate of the Igloolik yearly mean standing crop of zooplankton (without correction for straining efficiency of the No. 6xxx net) is 0.10 ml/m^2 or 5.2 ml/m^2 of surface area: the maximum observed was 0.50 ml/m^3. Another arctic coastal locality, in Greenland, had similar figures; coastal boreal stations have mean crops 4 to 8 times as great (volume basis) or 2 to 9 times as great (surface area basis). (Auth. abst.)

2885. Leim, A. H., and L. R. Day. 1959. RECORDS OF UNCOMMON AND UNUSUAL FISHES FROM EASTERN CANADIAN WATERS, 1950-1958. Journal of the Fisheries Research Board of Canada. Vol. 16, No. 4, pp. 503-514.

Records of fishes rare in Canada, and unusual occurrences of commoner ones, are presented for 65 species. First Canadian records are given for the short-nosed sturgeon (Acipenser brevirostrum), halfbeak (Hyporhamphus unifasciatus), four spot flounder (Paralichthys oblongus), weakfish (Cynoscion regalis) and striped sea robin (Prionotus evolvans). Specimens of unusually large size include a cunner (Tautogolabrus adspersus) of 17 1/4 inches and 3 1/4 lb, and a redfish (Sebastes marinus) of 31 1/2 inches and 23 1/2 lb. (Auths. abst.)

2886. Berg, L. S. (Translated by W. E. Ricker) 1959. SUMMER AND WINTER RACES AMONG ANADROMOUS FISHES. (YAROVYE I OZIMYE RASY U PROKHODNYKH RYB.) Published in Izvestiia Akademii Nauk SSSR, Otdel Matematicheskikh i Estestvennykh Nauk, for 1934, No. 5, pp. 711-732. Journal of the Fisheries Research Board of Canada.

Vol. 16, No. 4, pp. 515-537. Translation Series, No. 206.

This paper is one of the most interesting of the numerous scientific contributions of the late geographer and ichthyologist L. S. Berg, a member of the Academy of Sciences of the USSR. It marks the first attempt to bring together scattered information concerning intra-specific seasonal groups among anadromous fishes: that is, groups differentiated in respect to the time of their approach to fresh water and the time of their spawning. These seasonal races, as Berg calls them, occur in quite a variety of fishes, including a number of the important commercial fishes of Canada. A recognition of their existence is of profound importance both for fish-cultural procedures and for management policies.

Professor Berg's introduction to the subject of seasonal races is of such wide interest that it is profitable to make an English translation available, even 25 years after its original publication. (From translator W. E. Ricker's preface)

2887. Barnes, Harold, and Margaret Barnes. 1956. CONTENUTO DI FOSFORO TOTALE IN ALCUNI STADI DI DUE COMUNI ANIMALI PLANCTONICI D' ACQUA DOLCE E SUO RAPPORTO CON QUELLO DELLE LORO UOVA. (In Italian with English summ.) Memorie Dell' Istituto Italiano Di Idrobiologia Dott. Marco De Marchi. Vol. 9, pp. 113-124

The phosphorus contents of Cyclops strenuus and Daphnia longispina at various stages of development have been determined.

It is shown that there is a great accumulation of phosphorus in the eggs of both species. Utilisation of phosphorus is more efficient in egg-producing females. The bearing of the results on estimates of nutrient requirements particularly in relation to experimental studies on respiration are discussed. The results are in accord with other recent work indicating the importance of food in the egg laying of the marine copepod, Calanus finmarchicus. (Auths. abst.)

2888. Corbella, Carla. 1959. PLANCTON, BENTOS E CHIMISMO DELLE ACQUE E CEI SECIMENTI IN UN LAGO PROFONDO (LAGO MAGGIORE). IV. CARATTERISTICHE CHIMICHE DELL' ACQUA E DEI SEDIMENTI. Memorie Dell' Istituto Italiano Di Idrobiologia Dott. Marco De Marchi. Vol. 9, pp. 239-263.

The purpose of this research was to establish to what extent a correlation could be observed between sedimenting planktonic debris, chemical characteristics of water and sediments, and benthonic populations.

The samples of sediments were taken at five stations in Lake Maggiore at a depth of respectively 30,60,100, 200 and 300 meters. Water was sampled with a Nansen bottle, at different depths along the column of water 0-300 m; plankton was caught with a closing net between successive depth intervals along the same column of water.

As far as possible, planktonic debris has been identified and counted separately from living organisms, in order to ascertain how the successive layers of the whole column of water might enrich the bottoms situated at different depths, and in different seasons.

Dead zooplankton (Copepods) is more abundant in winter, and during overturn show a peculiar vertical distribution. For every considered species the mean annual value of dead individuals increases with depth as a percent on living ones within each layer; such a distribution is typically characteristic for spring, it being different in other seasons.

The question came up as to whether the living organisms found in deep layers may be regarded as included in biological cycles different from those of the surface, or may represent, as seems evident, a decaying picture of the epliminic biocoenosis.

The patterns of sedimentation of the most frequent algae are described and, as regards the role played by different groups in the enrichment of bottoms, Diatoms are considered the most important in every season, followed by Rotifers in summer and Copepods in winter.

The study of benthos has shown that Lake Maggiore must be regarded as a typical Tubificids lake, other organisms participating always with small numbers in the macrobenthos biocoenosis. The prevailing species are: Peloscolex ferox (Eisen), Bythonomous lemani Grube and Paammoryctes barbatus (Grube), which may be found at every depth, but with different ratios. The qualitative differences of benthos at increasing depths are not very important: under 100 m depth Niphargus becomes rather frequent, while the participation of Gammarids, Trichopters and Gasteropods, never abundant, completely disappears. The relative scarcity of Molluscs has reference to the inadequacy of the drainage basin nature.

At every depth the range of fluctuations of benthonic populations is considerably wide during the year cycle. The largest productivity of benthos as to be situated at 60 m depth (12 Kg pro hectar), decreasing with increasing depths (4 Kg pro hectar at 200 and 300 m).

The chemical characteristics of water and sediments in different depths and times are presented variations have been statistically analized and the compounds, to be considered as most characteristic of the allochtonous and the autochtonous portions of sediments, show an antagonistic mean distribution.

Correlations between the supplying column of water, the benthonic productivity and the chemical structure of both the environments are discussed. The mean annual values for macrobenthos, thanatoplankton, organic carbon and chlorophyll pigments show an analogous variation against depth. (Auth. abst.)

2889. Larkin, P. A. 1958. THE INVESTIGATION OF FISH-POWER PROBLEMS. H. R. MacMillan Lectures in Fisheries, Institute of Fisheries Univ. of British Columbia, Vancouver.

This is a binding of the papers presented at the April 29 and 30, 1957 symposium held at the University of British Columbia. These papers are: W. A. Clemens, "The Fraser River Salmon in Relation to Potential Power Development."; E. H. Vernon, "Power Development on Lakes in British Columbia.";

W. S. Hourston, "Power development and anadromous fish in British Columbia. "D. S. Rawson, "Indices to lake productivity and their significance in predicting conditions in reservoirs and lakes with disturbed water levels. "F. Neave, "Stream ecology and production of anadromous fish."; E. C. Black, "Energy stores and metabolism in relation to muscular activity in fishes."; J. R. Brett, "Implications and assessment of environmental stress."; G. Collins, "The measurement of performance of salmon in fishways."; F. E. S. Fry, "Approaches to the measurement of performance in fish."; and W. S. Hoar, "The analysis of behavior of fish."

2890. Winn, Howard E. 1958. COMPARATIVE REPRODUCTIVE BEHAVIOR AND ECOLOGY OF FOURTEEN SPECIES OF DARTERS (PISCES-PERCIDAE). Ecological Monographs. Vol. 28, No. 2, pp. 155-191.

The information presented in this paper is an attempt to treat comparatively the reproductive behavior and ecology of 14 species of darters which exhibit a great variety of habits and form, within one subfamily, Etheostomatinae. Each aspect of the habitat, sexual dimorphism, migration, reproductive season, territory, courtship, spawning act, care of eggs, sex recognition, and eggs is described for most of the species and is discussed from a compared with the phylogeny based entirely on morphology. The decisions on phylogeny based on behavior and on morphology are shown to be in general agreement. (Auth. abst.)

2891. Scofield, W. L. 1959. HISTORY OF KELP HARVESTING IN CALIFORNIA. California Fish and Game. Vol. 45, No. 3, pp. 135-157.

The principal species harvested is giant kelp, Macrocystis pyrifera, and the main area of harvesting has been and is southern California. There have been two periods of exploitation. The first just prior to and during World War I, 1911-1919, was mainly for the potash and acetone contained in the kelp. From the late 1920's to the present, harvesting has involved fewer companies but has been more systematic. Primary uses are for stock food (Kelp meal) and industrial products (algin). Operating factories, harvesting methods, regulations, and research are discussed. (Auth. abst.)

2892. Shapovalov, Leo, William A. Dill and Almo J. Cordone. 1959. A REVISED CHECK LIST OF THE FRESHWATER AND ANADROMOUS FISHES OF CALIFORNIA. California Fish and Game. Vol.45, No. 3, pp. 159-180.

This paper is a revision of a check list published in 1950. The main list includes native species and established exotics and consists of 110 full species comprising 23 families and 63 genera. Listed separately are fishes successfully introduced into the Salton Sea, forms removed from the main list since 1950, andexotic species unsuccessfully introduced or of uncertain occurrence. A total of 11 species and 7 subspecies have been added to the main list since 1950. (C. F.)

2893. Curtis, Brian. 1959. CHANGES IN A RIVER'S PHYSICAL CHARACTERISTICS UNDER SUBSTANTIAL REDUCTIONS IN FLOW DUE TO HYDROELECTRIC DIVERSION. California Fish and Game. Vol. 45, No. 3, pp. 181-188.

Studies were made on the Pit and Feather rivers of controlled flows of 50, 100, 150, 200, and 250 c.f.s. It was found that wetted perimeter decreases much less rapidly than volume of flow. Changes in maximum depth and area of cross section closely parallel wetted perimeter in percentage reduction, but mean velocity of water shows a very much greater percentage reduction. (C. F.)

2894. Claussen, L. G. 1959. A SOUTHERN RANGE EXTENSION OF THE AMERICAN SHAD TO TODOS SANTOS BAY, BAJA CALIFORNIA, MEXICO. California Fish and Game. Vol. 45, No. 3, pp. 217-218.

This note reports a southern range extension on the Pacific coast of North America of the American shad (Alosa sapidissima). The specimen was obtained in July of 1958. A brief description of the fish is given. (Auth. abst.)

2895. Chakrabarty, R. D., P. Roy, and S. B. Singh. 1959. A QUANTITATIVE STUDY OF THE PLANKTON AND THE PHYSICO-CHEMICAL CONDITIONS OF THE RIVER JUMNA AT ALLAHABAD IN 1954-55. Indian Journal of Fisheries. Vol. 6, No. 1, pp. 186-203.

The physico-chemical conditions obtained in the month of April appear to be optimum for the growth of diatoms and June conditions favour the growth of Chlorophyceae, Myxophyceae, Rotifera and Entomostraca. Low temperature on the other hand retards plankton production as observed in January. Turbidity, current and influx of rain-water from floods seem to have detrimental effect on plankton. However, it is found that these factors bring about an enrichment of the water as regards some of the nutrients. Alkalinity is observed to bear inverse relation with the phytoplankton during the active period of metabolism. Phosphates seem to have a more significant inverse relationship with the phytoplankton than the nitrates. The highest number of phytoplankton is 619 units and zooplankton 189 units per litre in June, the lowest number of phytoplankton is 19 units and of zooplankton 9 units per litre in October. The annual phytoplankton mean is 245 units and zooplankton 84 units per litre. The ratio of zooplankton to phytoplankton is found to be 1:3. Diatoms are the dominant group (49.7%) amongst the phytoplankton and Rotifers (53.6%) amongst the zooplankton. Chlorophyceae and Myxophyceae are observed to be abundant during the period of strong solar illumination and the zooplankton tend to avoid it. Direct relationship between lunar illumination and plankton is also seen. (Auth. summ.)

2896. Jones S. 1959. NOTES ON EGGS, LARVAE AND JUVENILES OF FISHES FROM INDIAN WATERS. II. Istiophorus gladius (Broussonet). Indian Journal of Fisheries. Vol. 6, No, 1, pp. 204-210.

There were sixteen larval specimens of the sailfish, Istiophorus gladius (Broussonet) ranging in length from 3·4-11·75 mm. This appears to be the first record of larval sailfish from Indian waters and since there are no descriptions of larvæ of this species, some of the typical stages are described briefly and figured.

In spite of the limited nature of the collection it is evident from the available material that the sailfish breeds over a fairly extensive area in the Laccadive Sea. It is of interest to note that both the smallest and the largest specimens were collected from the same Station. Regular observations over a wider area for a longer period will throw interesting light on the breeding of this fish in this part of the Indian Ocean.

2897. Das, B. C. 1959. COMPARATIVE EFFECTS OF VITAMIN B_{12}, COBALT NITRATE AND RUMINANT STOMACH EXTRACT ON THE SURVIVAL RATE OF INDIAN CARP DURING THE FIRST THREE WEEKS OF LIFE. Indian Journal of Fisheries. Vol. 6, No. 1, pp. 211-221.

One day old Indian carp (Catla catla, Labeo rohita, Cirrhina mrigala) were randomly allocated to five treatments consisting of crystalline vitamin B_{12}, 25 and 50 µg. cobalt nitrate alone, cobalt nitrate with extract of goat's stomachs, and an untreated control. Treatment lasted for 19 days.

Statistical analysis of the results showed that two treatments significantly enhanced survival at the 5% level of confidence during the first 3 weeks following hatching. 50 µg. B_{12}, and cobalt nitrate combined with extract of goat's stomachs.

Examination of the daily survival rates indicates that effectiveness of the experimental treatments was highest during the period of low survival, i.e., high mortality.

For the 19-day experimental period, the cost of the treatment with 50 µg. B_{12} was Rs. 34·00 and the cost of the cobalt combined with extract of goat's stomachs was Re.0·06. (Auth. summ.)

2898. Anonymous. 1958. NINTH ANNUAL REPORT OF THE SUPERVISORY COMMITTEE FOR BROWN TROUT RESEARCH, 1956-1957. Scottish Home Department, Freshwater and Salmon Fisheries Research. H. M. Stationery Office, Edinburgh, 1958. 14 pp.; Water Pollution Abstracts. Vol. 32, No. 7, Abst. 1206, 1959.

The report of the Freshwater Fisheries Laboratory (formerly the Brown Trout Research Laboratory) for the year ending 31st October 1957 contains information on laboratory and fieldwork carried out during the year. Studies on the fertilization of lochs has been extended by the addition of 2 lochs in the Pitlochry area and 2 others on Islay. Investigations on the "homing" behaviour of trout during spawning runs have been continued. The physical characters of streams in relation to migratory movements have been investigated and laboratory experiments have been made on the growth of trout. Observations on bottom fauna have been continued. The numbers of emerging insects have been found to vary from season to season and from place to place within one loch, and this no doubt causes local migrations of trout in search of food, while the condition of the fish may be related to the fluctuations in numbers and time of emergence of the insects. Observations have been made during the year on phytoplankton in fertilized lochs, and the chemical composition of the water in these lochs has been determined.

2899. D. W. Graham. 1958. pH-ALKALINITY. Wat. and Sewage Wks, 105, R. 386; Water Pollution Abstracts. Vol. 32, No. 7, Abst. 1219, 1959.

A chart is given indicating the relation between type of alkalinity and pH value in natural and treated waters and in laboratory titrations.

2900. Nusbaum, I. 1958. DISSOLVED OXYGEN DETERMINATION. Wat. and Sewage Wks, 105, 469-471; Water Pollution Abstracts. Vol. 32, No. 7, Abst. 1224, 1959.

A modification of the Winkler method for the determination of dissolved oxygen, using sulphamic acid instead of concentrated sulphuric acid, is described. Comparative analyses using the two acids showed no significant difference in the results obtained, and the advantages in the use of sulphamic acid in either the crystalline form or in solution, both in the laboratory and in the field, are enumerated. Sulphamic acid is readily available, cheap, non-hazardous, non-volatile, nonhygroscopic, and is of similar strength to sulphuric acid, though not so corrosive; it also eliminates interference from nitrites. Procedure follows that of the Winkler method proper, and the addition of sodium azide for the removal of nitrite is not necessary as it has already been found in another modification of the method, that sulphamic acid may be used for that purpose also. Graphs are presented showing the solubility of sulphamic acid in water, its comparative strength, and the solubility of some of its salts; and tables are given showing some results of the analyses.

2901. Briggs, R., G. V. Dyke, and G. Knowles. 1959. ELECTRICAL RECORDER FOR DISSOLVED OXYGEN. Wat. Waste Treatm. J., 7, 197; Water Pollution Abstracts. Vol. 32, No. 7, Abst. 1225, 1959.

A brief description is given of the operation and maintenance of an automatic recorder for dissolved oxygen during its use on the river Hiz, Herts. A diagram of the apparatus, which has previously been described in detail, is included.

2902. Todt, F., and R. Freier. 1957. ELECTROCHEMICAL MEASUREMENT OF DISSOLVED OXYGEN IN WATER. G. P. 926,208; Chem. Zbl., 128, 9187; Water Pollution Abstracts, Vol. 32, No. 7, Abst. 1226, 1959.

For determination of dissolved oxygen in water a galvanic element is used whose current delivery is dependent on the amount of oxygen reaching the cathode surface. A sufficient activation of the anode is obtained by use of one metal, for example iron, in combination with a baser metal, for example zinc or

magnesium.

2903. Todt, F. J. P. 1957. ELECTROCHEMICAL MEASUREMENT OF DISSOLVED OXYGEN IN WATER. G. P. 936,116; Chem. Zbl., 128, 9186-9187; Water Pollution Abstracts. Vol. 32, No. 7, Abst. 1227, 1959.

For the measurement of oxygen dissolved in water a galvanic element is used. The measuring electrode is quiescent mercury or a mercury alloy (amalgam) so that deposits, for example of lime, are avoided.

2904. Ways, H. C., and D. S. Davis. 1958. SOLUBILITY AND PERCENTAGE SATURATION OF OXYGEN IN WATER. Wat. and Sewage Wks, 105, 537; Water Pollution Abstracts. Vol. 32, No. 7, Abst. 1228, 1959.

A previous nomograph for the solubility of atmospheric oxygen in water (see Wat. Pollut. Abstr., 1958, 31, Abstr. No. 588) has been modified to include percentage saturation values.

2905. Daum, M., and J. R. Salvesen. 1958. TURBINE AERATION AS A METHOD OF INCREASING THE PURIFICATION CAPACITY OF A STREAM. T. A. P. P. I., 41, 800-803; Water Pollution Abstracts. Vol. 32, No. 7, Abst. 1240, 1959.

Studies have been made at the plant of the Marathon Division of the American Can Co. at Rothschild, Wis., on the use of turbines for aeration of the Wisconsin river. It was found that the amount of oxygen which could be introduced into the water by this method varied from 0·2 p. p. m. to over 1 p. p. m. The amount of oxygen absorbed by the water appeared to depend on the volume of water passing through the turbine, the amount of air admitted into the turbine, and the concentration of oxygen already dissolved in the water. Introducing air into the turbine does result in some loss of power production, but the expense of this is low enough to be economically supportable. It is recommended that air should be introduced into the turbines when the river water is low in dissolved oxygen; this might require continuous aeration during the whole of August and parts of June, July, and September.

2906. Anonymous. 1958. THE RUHR. REPEATED DESTRUCTION OF FISH. Mitt. Ver. dtsch. Gewässerschutz, No. 3/4, 11; Water Pollution Abstracts. Vol. 32, No. 7, Abst. 1331, 1959.

During the past year destruction of fish has occurred three times in the Ruhr and eleven times in tributaries. The sources of all the damaging discharges were traced and in two instances legal action was taken. These two cases were both of pollution by oil. The condition of the Ruhr as a fishing river is improving year by year and the importance of preventing damage is emphasized.

2907. Gaufin, A. R. 1958. THE EFFECTS OF POLLUTION ON A MIDWESTERN STREAM. Ohio J. Sci., 58, 197-208; Publ. Hlth Engng Abstr., 1958, 38, No. 12, 33-34 (S: 109-S: 110); Water Pollution Abstracts. Vol. 32, No. 7, Abst. 1333, 1959.

A study of environmental conditions in the Mad river, Calif., was conducted by the author during the unusually dry period from 1952-1953 and in 1955. Wastes are discharged at Urbana and Springfield, a large proportion from the former being paper mill waste waters which have a high B. O. D. and cover the bottom with paper fibres. A total of 166 species representing 122 genera of macro-invertebrates were collected and identified. The largest number of species was taken in the headwater section above Zanesfield in May 1953. The selective effect of heavy organic enrichment was most obvious below Springfield where only fourteen species were collected at any one time, all but two of these being polysaprobic forms. The movement and accumulation of paper mill waste waters downstream from Urbana between 1952 and 1955 resulted in some interesting changes in numbers and composition of fauna at several of the sampling stations. Between May 1953 and October 1955 the number of species occurring between Urbana and Springfield was reduced by approximately 66 per cent and all gill-breathing forms, except one species of Hydropsyche, had disappeared. The leeches, snails, sludge worms and water sow bugs that remained occurred in tremendous numbers. The macro-invertebrates collected were classified into clean water, facultative and pollution-preferring species represented. By contrast, 50-100 per cent of the macro-invertebrates occurring below Urbana during the 1955 survey were pollution-tolerant forms with no clean-water forms present immediately below Urbana and Springfield. A list of references is appended.

2908. Mackenthun, K. M. 1958. THE CHEMICAL CONTROL OF AQUATIC NUISANCES. A REPORT ON THE USE OF CHEMICALS ON LAKES, PONDS AND STREAMS FOR THE CONTROL OF ALGAE, WEEDS AND OTHER AQUATIC NUISANCES. Committee on Water Pollution, Madison, Wis., 64 pp.; Water Pollution Abstracts. Vol. 32, No. 7, Abst. 1340, 1959.

The author discusses the use of chemicals for the control of aquatic weeds and algae, including the calculation of the amount of chemical required, the equipment for application of the chemical, and precautions to be taken. The effects of treatment are described. Sodium arsenite is usually used for the control of aquatic weeds and copper sulphate for the control of algae. A section is also included on the nature and development of swimmer's itch and on chemical control of the snails which form the alternate host of the schistosome cercariae. Snails can be killed by treatment with copper sulphate and copper carbonate or with copper sulphate and fresh hydrated lime. Tables are given showing the lakes in Wisconsin which have received treatment with copper sulphate or sodium arsenite during the past 8 years.

2909. Merkens, J. C. 1958. STUDIES ON THE TOXICITY OF CHLORINE AND CHLORAMINES TO

THE RAINBOW TROUT. Wat. Waste Treatm. J., 7, 150-151; Water Pollution Abstracts. Vol. 32, No. 7, Abst. 1342, 1959.

Chlorine might be discharged to rivers in the effluents from the bleaching of paper and textiles, in cooling waters to which it has been added to control slime growths, and in waste waters from many other processes in which a cheap disinfectant or oxidizing agent is required. The receiving stream may frequently contain ammonia, and experiments were therefore carried out to investigate the toxicity of chlorine to rainbow trout (Salmo gairdnerii) in solutions containing ammonia. It was found that the toxicity depended, not on the amount of chlorine added, but on the concentration of residual chlorine remaining in solution, and this in turn depends on the relative proportions of free chlorine and chloramines of which it is composed. Although these relative proportions can be measured, not enough is yet known for the toxicity of a given mixture to be assessed precisely from the results. However, as the toxicities of chlorine and the chloramines to fish are of the same order, with free chlorine being the most toxic, it can be assumed for pollution control purposes that any residual chlorine in river waters has the toxicity of free chlorine; if, as is likely, much of it is in the form of the less toxic chloramines, some margin of safety would then exist. Since 0, 08 p. p. m. residual chlorine, mostly in the form of monochloramine, killed about one-half of a batch of rainbow trout in 7 days when the concentration of dissolved oxygen was nearly 100 per cent of the air saturation value, it appears that a safe concentration may be very low.

2910. Kabler, P. 1958. USE AND VALUE OF BACTERIAL INDICATORS OF POLLUTION. Biological Problems in Water Pollution, Robert A. Taft Sanitary Engineering Centre, Cincinnati, Ohio, 43-49; Publ. Hlth Engng Abstr., 38, No. 12, 32 (S:108); Water Pollution Abstracts. Vol. 32, No. 7, Abst. 1351, 1959.

The author discusses the results of a study on bacterial indicators of pollution. No satisfactory alternative to the coliform group has yet been discovered. A list of references is given.

2911. Boyd, W. L. 1959. LIMNOLOGY OF SELECTED ARCTIC LAKES IN RELATION TO WATER SUPPLY PROBLEMS. Ecology, 40, 49-54; Water Pollution Abstracts. Vol. 32, No. 8, Abst. 1376, 1959.

In the past, melted ice and snow have been used for water supplies in the arctic coastal plain of northern Alaska, but with the recent establishment of hospitals, schools, and military establishments the need for large supplies of water has become more urgent, and it has been necessary to use lakes and rivers which do not freeze to the bottom during the winter months. A study has been carried out on certain lakes to determine their potability. It was found that the composition of the water became more concentrated with increase in ice cover, and any type of treatment for drinking or boiler purposes must be varied to meet the marked seasonal changes in the quality of the water. A suitable lake should be more than 8 ft deep as the greater the depth the less concencentrations occurs. A low mineral content during the ice-free period is one of the more important criteria in the selection of a potential water supply. Small lakes can be used as temporary sources in summer and early autumn, but the quality of the water becomes progressively poorer especially as the ice approaches the bottom of the lake. In general, most of the lakes studied were potable and could serve as a satisfactory water supply except during and shortly after the run-off period when contamination from soil run-off occurred. From the data obtained it is assumed that coliform organisms do not survive for long periods in arctic lake water.

2912. Talling, J. F. 1958. PHOTOSYNTHETIC CHARACTERISTICS OF SOME FRESHWATER PLANKTON DIATOMS IN RELATION TO UNDER-WATER RADIATION. New Phytol., 1957, 56, 29-50; Coll. Pap. Freshw. biol. Ass. 1957, Contr. No. 303; Water Pollution Abstracts. Vol. 32, No. 8, Abst. 1411, 1959.

The photosynthetic characteristics of natural and cultured populations of the diatom, Asterionella formosa are described. The relation between photosynthesis and light intensity was determined, with particular reference to the onset of saturation in relation to light intensity. An increase in the light-saturation in relation to light intensity. An increase in the light-saturated rate of photosynthesis with temperature was observed. The variation in photosynthetic behaviour in different natural and cultured populations is discussed. Less detailed studies were also made on the characteristics of two other planktonic diatoms.

2913. Anonymous. 1958. SYMPOSIUM ON DETERMINATION OF DISSOLVED OXYGEN IN WATER. American Society for Testing Materials, ASTM Spec. Tech. Publ. No. 219, 64 pp.; Water Pollution Abstracts. Vol. 32, No. 8, Abst. 1427, 1959.

The text is given of papers, with the subsequent discussions, presented at a symposium on the determination of dissolved oxygen which was held at the 60th Annual Meeting of the American Society for Testing Materials in June 1957. The papers included a study of the accuracy of methods of testing for dissolved oxygen in high-purity water; the polarographic measurement of dissolved oxygen; and the use of the Beckman dissolved oxygen analyser, the Hartmann and Braun dissolved oxygen recorder for boiler feed water, and the Cambridge analyser.

2914. Anonymous. 1959. THE MICRODETERMINATION OF DISSOLVED OXYGEN BY HYPODERMIC SYRINGE. Holland, P. Chem and Ind. 218-219; Water Pollution Abstracts. Vol. 32. No. 8, Abst. 1429, 1959.

Equipment and procedure are described for sampling boiler feed water with a 1-ml syringe, and determining the dissolved oxygen content by an absorptiometric method using the ortho-tolidine reagent.

Precautions are taken to avoid the introduction of air bubbles. The method was developed for measuring oxygen concentrations below 0·01 p.p.m. and the results are reproducible to at least 0·003 p.p.m.; for concentrations greater than 0·02 p.p.m. a correction must be applied.

2915. Laurent, P.J. 1958. RESISTANCE OF FRESH-WATER CRUSTACEANS TO THE ACTION OF SODIUM CHROMATE. Verh. int. Ver. Limnol., 1956, 13, 590-595; Water Pollution Abstracts. Vol. 32, No. 8, Abst. 1534, 1959.

In studies to investigate organisms requiring a shorter duration of toxicity test than fish, it was found impossible to use Asellus, owing to cannibalism of groups in captivity and excessive mortality when the individual organisms were isolated. The results of tests with Gammarus pulex pulex were more satisfactory and are shown graphically. In a solution containing 85 mg of sodium chromate per litre, total mortality occurred after 2 hours 40 minutes, and with a dose of 4·3 mg per litre after 68 hours 30 minutes. In these two solutions, the greatest mortality occurred after 13 hours 10 minutes and 24 hours 25 minutes, respectively. The delay before the first signs of intoxication was not, however, related to the concentration of chromate. When the time of greatest mortality was plotted against concentration, both on logarithmic scales, a straight line was obtained, in the range 4·3-8·4 mg of chromate per litre. Further experiments will be undertaken to compare the resistance of Gammarus to sodium chromate with that of fish.

2916. Henderson, C., Q.H. Pickering, and J.M. Cohen. 1959. THE TOXICITY OF SYNTHETIC DETERGENTS AND SOAPS TO FISH. Sewage industr. Wastes, 31, 295-306; Water Pollution Abstracts. Vol. 32, No. 8, Abst. 1538, 1959.

After a brief review of the work of various investigators on the toxicity of synthetic detergents to fish, the authors describe experiments to determine the toxicity to fish of 5 packaged household synthetic detergents and 3 soap powders or flakes, in a synthetic very soft water and in a natural hard water. It was found that the synthetic detergents were all toxic to fish at moderate levels, and the average toxicity was slightly higher in hard than in soft water. The fish appeared to react fairly rapidly, with only a slight cumulative or chronic toxicity resulting from longer exposure. The three soaps tested were found to be very slightly more toxic than synthetic detergents in the soft water but much less toxic in the hard water, probably because of the formation of insoluble complexes or precipitates in hard water. Again the cumulative or chronic toxic effect on prolonged exposure was slight. The toxicity of some of the major surface-active agents and builders used in the preparation of the packaged products was also tested. Alkyl benzene sulphonates were found to be highly toxic to fish while the builders contributed little if any toxicity. Sodium lauryl sulphate, while as toxic as alkyl benzene sulphonate, was not as resistant to biological degradation and would therefore be expected to be present in natural waters in lower concentrations. A polyoxyethylene ester type of surface-active agent was much less toxic than the others. None of the surface-active agents tested appeared to affect water quality characteristics such as dissolved oxygen concentration, pH value, alkalinity, and hardness; some of the synthetic detergents and the sodium tripolyphosbuilder did however have some effect on pH value, alkalinity, and hardness. From these experiments, the authors conclude that concentrations of alkyl benzene sulphonates greater than 1-2 p.p.m. may be expected to have some effect on the more sensitive fish and other aquatic organisms in natural waters, and further investigations on the concentrations of alkyl benzene sulphonates in natural waters and field studies of aquatic populations in water containing significant concentrations of alkyl benzene sulphonate, are necessary. A bibliography of 34 references is appended.

2917. Mann, H. 1958. THE EFFECT OF VARIOUS DISINFECTANTS ON FISH AND ANIMALS SERVING AS FISH FOOD. Z. Fisch., 1957, 6, No. 1-7, 135-140; LitBer. Wass. Anwass. Luft u. Boden, 1958, 7, 82; Water Pollution Abstracts. Vol. 32, No. 8, Abst. 1539, 1959.

The author describes experiments on fish with a number of detergents of different types with bactericidal action and other disinfectants. Both the time of the first manifestation of damage and the time of the first manifestation of damage and the time of death were observed. The results showed little difference in the toxic effects of the various materials. Limiting concentrations varied from 10 to 50 mg per litre for fish. Experiments on organisms serving as fish food were also made. With Daphnia the first damage was observed at 5 mg per litre. Adaptation to the poison took place when concentrations were slowly increased. Increase of temperature increased toxicity and increased carbonate hardness decreased the effect.

2918. Schiffman, R.H., and P.O. Fromm. 1959. CHROMIUM-INDUCED CHANGES IN THE BLOOD OF RAINBOW TROUT, SALMO GAIRDNERII. Sewage Industr. Wastes, 31, 205-211; Water Pollution Abstracts. Vol. 32, No. 8, Abst. 1540, 1959.

Experiments were made on the effect of exposure to non-actively lethal levels of chromium on the physiology of the blood of rainbow trout. The percentages of red blood cells (haematocrits) on both splenectomized and intact fish exposed to 20 mg of chromium per litre were significantly higher than for control fish in clean tap water. Exposure of fish to concentrations as low as 2-4 mg per litre was found to raise the haematocrit to its maxium value. the presence of the spleen was found to have no effect on the rise in haematocrit under chromium stress. The potential influence of the potassium ion in the potassium dichromate on the experimental results is discussed.

2919. Albersmeyer, W. Fischwirt. 1957. THE EFFECT OF PHENOLIC WASTE WATER ON FISH.

7, 207-211; LitBer. Wass. Abwass. Luft u. Boden, 6, 243; Water Pollution Abstracts. Vol. 32, No. 8, Abst. 1542, 1959.

The author deals with the effects of phenolic waste waters discharged to streams, with special reference to their action on fish. Considerable differences are found in the toxicity of different phenols and derivatives, and toxicity is also affected by various factors such as dilution, temperature, and oxygen content. Phenolic taste in fish is not caused by phenols, cresols, and xylenols but by the accompanying substances in waste waters of the tar industry.

2920. Plomann, J. 1958. THE PLANT POISON "ROTENONE" AND ITS IMPORTANCE FOR FISHERIES. Dtsch. FischZtg, 5, No. 1, 22-25; LitBer. Wass. Abwass. Luft u. Boden, 1958, 7, 82; Water Pollution Abstracts. Vol. 32, No. 8, Abst. 1543, 1959.

The author gives an account of the source, chemical composition, and importance of Rotenone, which is lethal to fish in concentrations of 1 in 10 mil. Its use in America and in Denmark for clearing waters of valueless or diseased fish and legislation on the restocking of such poisoned waters are described.

2921. Watson, D. G., and J. J. Hanford Davis. 1959. CONCENTRATION OF RADIO-ISOTOPES IN COLUMBIA RIVER WHITEFISH IN THE VICINITY OF THE HANFORD ATOMIC PRODUCTS OPERATION. Atomic Products Operation, Richland, Wash., HW-48523 (Del.), 1958. 134 pp.; Nuclear Sci. Abstr., 13, 165; Water Pollution Abstracts. Vol. 32, No. 8, Abst. 1545, 1959.

Results of a study on the uptake of radioactive isotopes by whitefish in the Columbia river for the period June 1950 to December 1956, are presented. Differences in concentrations of radioactive materials as related to geographical location, season, age, specific tissue, and concentration of reactor effluent in the river are discussed. It was concluded that human consumption of whitefish flesh at the rate of 2·7 lb per week from public fishing areas during the autumn months would produce maximum permissible concentrations of phosphorus-32.

2922. Vivier, P. 1957. IMPORTANCE OF BIOLOGICAL TESTS FOR THE PROTECTION OF RIVERS AGAINST POLLUTION. U. N. Food and Agric. Org., Gen. Fish. Counc. Medit. Proc. tech. Pap., No. 4, 207-217 (English summary); Water Pollution Abstracts. Vol. 32, No. 8, Abst. 1550, 1959.

In a paper presented at a meeting in Istanbul, 1956, the author reviewed biological tests on the effects of toxic substances discharged to rivers, with particular reference to fish tests, including laboratory tests with water of known composition and tests with fish immersed in cages in the river, samples of the river water being taken for analysis. Both short- and long-term fish tests are discussed and tests on other fauna and flora are considered. A bibliography of 20 references is appended.

2923. Tesch, F. W. 1958. NUTRITION AND GROWTH OF SALMONIDAE IN AN IMPOUNDING RESERVOIR. Limnol. Schr Reihe, 5, No. 20, 40-55; Water Pollution Abstracts. Vol. 32, No. 9, Abst. 1610, 1959.

The author describes an investigation into the feeding habits and growth of Salmo irideus, S. fontinalis, and S. trutta fario in the impounding reservoir of Cranzahl in the Erzgebirge. The reservoir is new, lies at a height of 715 m, and has an area of 30 ha. Analyses of the water and of the population of nutrient organisms showed conditions favourable for the growth of Salmonidae. Details are given of the amount and kind of food found in the fish stomachs at different seasons and conclusions are drawn as to the feeding places of the fish. Measurements of growth showed that it was good in all three types. Multiplication of S. fontinalis and S. trutta took place but was not proved for S. irideus. The author recommends stocking with S. fontinalis.

2924. Anonymous. 1959. CONFERENCE ON PHYSICAL AND CHEMICAL PROPERTIES OF SEA WATER. Nat. Acad. Sci.-Nat. Res. Counc., Publ. 600, 214 pp; Water Pollution Abstracts. Vol. 32, No. 9, Abst. 1615, 1959.

The text is given of papers presented at the conference, sponsored jointly by the Office of Naval Research and the Committee on Oceanography in September 1958, on physical and chemical properties of sea water. The conference was intended to indicate what research is required on this subject. Draft recommendations of the committees on field measurements, on chemical properties, are included.

2925. Freier, R., and G. Resch. 1957. DETERMINATION OF DISSOLVED OXYGEN IN WATER. Z. anal. Chem., 1956, 148, 427-434; Chem. Zbl., 128, 11123; Water Pollution Abstracts. Vol. 32, No. 9, Abst. 1628, 1959.

Determination of dissolved oxygen by Winkler's iodometric method can be affected by reducing substances in the water and by oxidation by atmospheric oxygen. Using photometric methods the authors found that at pH 2·3-2·5 oxidation by atmospheric oxygen and reduction by hydrazine ($<$2 mg per litre) were approximately compensating; there remained a maximum error of $\pm$5 µg of oxygen per litre. Analytical methods applicable to contents up to 500 µg of oxygen per litre are described.

2926. Greene, M. W., and R. W. Negus. 1958. METHOD OF MEASURING AND RECORDING OF SMALL CONCENTRATIONS OF OXYGEN DISSOLVED IN WATER. Proc. Amer. Pwr Conf., 1957, 19, 741-746; Mon. tech. Bull. int. Combust. Ltd., 12, 385; Water Pollution Abstracts. Vol. 32, No. 9, Abst. 1629, 1959.

The necessity for a reliable method of measuring the concentration of dissolved oxygen in water, particularly boiler feed water, is stressed, and the disadvantages of present methods are mentioned briefly. An analyser for the measurement of dissolved oxygen in water is described, and details of its operation and maintenance are given. The method is based on the simple chemical reaction of oxygen

with nitric oxide and water to form nitrous acid. From results of its performance, it was found that reproducible measurements of as low as 1 p. p. 1000 mil. could be obtained.

2927. Tyler, C. P., and J. H. Karchmer. 1959. PORTABLE ANALYSER FOR DETERMINATION OF DISSOLVED OXYGEN IN WATER. APPLICATION OF RAPID-DROPPING MERCURY ELECTRODE. Analyt. Chem., 31, 499-502; Water Pollution Abstracts. Vol. 32, No. 9, Abst. 1630, 1959.

A portable polarographic apparatus has been developed for the determination of dissolved oxygen in water and waste waters. It uses a mercury drop time of about 0·25 sec per drop, which produces a current relatively insensitive to agitation or to sample flow. The low drop time is achieved by mounting the dropping mercury electrode horizontally in the electrolytic cell and by judicious selection of the parameters of the capillary. The method is applicable to samples with pH values of 4·5-11·0 and with salt concentrations between 0·001 and 0·05 M. Detailed procedure is given for constructing the apparatus and carrying out the determination.

2928. Karchmer, J. H. 1959. POLAROGRAPHIC DETERMINATION OF DISSOLVED OXYGEN. STUDY OF DROP TIME WITH RAPID-DROPPING MERCURY ELECTRODE. Analyt. Chem., 31, 502-508; Water Pollution Abstracts. Vol. 32, No. 9, Abst. 1631, 1959.

A single capillary was used to study the effect of very small drop times at a constant mercury flow rate on the polarographic current produced by dissolved oxygen in water. The capillary was mounted first vertically, then horizontally, and finally its orifice was scratched and it was mounted vertically. Currents produced with very low drop times were considerably less than those predicted from the Ilkovic equation. When the solutions are stirred the effect on the current is less as the drop time decreases and the mercury flow rate becomes greater. The fundamental equations governing the drop times and mercury flow rate were studies and reduced to simple forms so that predictions involving mercury pressure, capillary length, capillary radius, and interfacial tension could be made in selecting capillaries of desired characteristics.

2929. Winn, Howard E. 1960. BIOLOGY OF THE BROOK STICKLEBACK EUCALIA INCONSTANS (KIRTLAND). The American Midland Naturalist, Vol. 63, No. 2, pp. 424-438.

The biology of the brook stickleback with emphasis on reproduction is described with the inclusion of all the literature available to the author at this time.

The brook stickleback lives in small pond-like areas and streams where the water is clear and where heavy vegetation occurs. It is restricted essentially to spring-fed areas in Ohio and southern Michigan.

The fish mature in one year, eat primarily insects and crustacens and are eaten occasionally by some fish which are listed.

The fish migrate to shallow water to spawn in April, May and June at temperatures between at least 15° and 19°C. The nesting period starts later in the season north of southern Michigan.

A detailed description is given of their reproductive activities under laboratory conditions. This is then broadened to include field observations and those of other authors. The following activities are described: territoriality, nest building and repair, spawning, egg fanning, caring for eggs, and caring for young. Males with only eggs ate young larvae placed near them, whereas, males with young retrieved the larvae if alive and spit them into the nest.

The nests may have one or two holes. The second is produced by the female and variously repaired by the male. The nests are made of bits of dead organic debris and various pieces of live plants such as algae. The positions of nest are given and they are most often placed just off the bottom attached to some object. The eggs are described and hatching times given. (Auth. summ.)

++++++++++++++++++++++++++++

AUTHOR INDEX FOR VOLUME IV

Acolat, L.
Researches relating to the reaction of the isolated heart of Esox lucius to the passage of an electrical current. (Recherches Relatives A La Reaction Du Coeur Isole Du Crochet (Esox lucius L.) Au Passage Du Courant Galvanique). 2212

Adlung, K. G.
The toxicity of insecticides to fish and its dependence on temperature. 2166
The toxicity of insecticidal and acaricidal agents to fish. 2165
Toxicity of dinitrocarbazole to fish. 2686

Agafanov, B. M.
Some experiments in biological de-activation of (radioactive) water. Laboratory tests in small tanks. 2453

Albersmeyer, W. Fischwirt.
The effect of phenolic waste water on fish. 2919

Alderdice, D. F., and J. R. Brett.
The resistance of cultured young chum and sockeye salmon to temperatures below 0° C. 2252

Alderdice, D. F., J. R. Brett, and M. Hollands.
The effect of temperature on the cruising speed of young sockeye and coho salmon. 2274

Alderdice, D. F., and W. P. Wickett.
A note on the response of developing chum salmon eggs to free carbon dioxide in solution. 2251

Alexander, Elizabeth C., Thomas W. McKenney, and Gilbert L. Voss.
Early development and larval distribution of the Carangid fish, Caranx crysos (Mitchill). 2201

Alexander, R. McN.
The physical properities of the swimbladders of fish other than Cypriniformes. 2721
The physical properties of the isolated swimbladder in Cyprinidae. 2720
The densities of Cyprinidae. 2719
The physical properties of the swimbladder in intact Cypriniformes. 2718

Ali, M. A., and J. R. Brett.
Some observations on the structure and photomechanical responses of the Pacific salmon retina. 2253

Ali, M. A., and W. S. Hoar.
Retinal responses of pink salmon associated with its downstream migration. 2741

Allen, Donald M., and Anthony Inglis.
A pushnet for quantitative sampling of shrimp in shallow estuaries. 2284

Allen, George H.
Notes on the fecundity of silver salmon, (Oncorhynchus kisutch). 2174
Behavior of chinook and silver salmon. 2349

Aller, Barbara B.
Publications of the United States Bureau of Fisheries 1871-1940. 2190

Ambuhl, H.
The practical utilization of electrochemical oxygen determination in water. (Die Praktische Anwendung Der Elektrochemischen Sauerstoff Bestimmung Im Wasser). 2607

Anas, Raymond E.
Three-year-old pink salmon. 2366

Anderson, D. C., J. C. Ayers, D. C. Chandler, and G. H. Lauff.
Currents and water masses of Lake Huron. (1954 synoptic surveys). 2683

Anderson, G. C., and G. W. Comita.
The seasonal development of a population of Diaptomus ashlandi Marsh, and related phytoplankton cycles in Lake Washington. 2330

Anderson, William D., and Harry W. Freeman.
Fishes of the Congaree River drainage, South Carolina. 2244

Anderson, William W.
Larval development growth, and spawning of striped mullet (Mugil cephalus) along the South Atlantic coast of the United States. 2186

Anderson, William W., and Jack W. Gehringer.
Physical oceanographic, biological and chemical data--South Atlantic coast of the United States. M/V Theodore N. Gill Cruise 6. 2288

Andrew, F. J., and G. H. Green.
Sockeye and pink salmon investigations at the Seton Creek hydroelectric installation. 2503

Annan, Murvel E.
Notes on the food of the young of three species of Pacific salmon in the sea. 2197

Anonymous.
Laws and regulations for protection of the commercial fisheries of Alaska, 1959. 2375.
Methods of testing water: Determination of pH value. 2155
Deadly Mix. 2169
Study reveals pike movements. 2211
Symposium on chemistry of the sea. 2217
On the biological institute of water reservoirs. 2230
Biological problems in water pollution. 2690
Hanford biology research. Annual report for 1957. 2691
The toxicity of chemicals on fish. II. The estimation of the effectiveness of insecticides on the young carp, Cyrinus carpio Linne. 2799
List of publications from the department of fisheries, faculty of agriculture, Kyoto University during the period 1947-1957. 2800
Oxygen relationships in streams. 2822
Progress report on Alaska fishery management and research, 1958. 2852
Ninth annual report of the supervisory committee for brown trout research, 1956-57. 2898
The Ruhr. Repeated destruction of fish. 2906
The microdetermination of dissolved oxygen by hypodermic syringe. 2914
Symposium on determination of dissolved oxygen in water. 2913
Conference on physical and chemical properties of sea water. 2924

Anraku, Masateru.
Some experiments on the variability of horizon-

tal plankton hauls and on the horizontal distribution of plankton in a limited area. 2547

Anthony, E. H. and F. R. Hayes.
Lake water and sediment. VI. The standing crop of bacteria in lake sediments and its place in the classification of lakes. 2781

Aoyama, Tsumeo.
On the regeneration of the teleost scale, with special reference to the yellow sea bream, Taius tumiforns. 2796

Arasaki, S., K. Nozawa, and M. Miyaki.
On the pathogenetic water mold. I. 2803
On the pathogenetic water mold. II. 2804

Armitage, Kenneth B.
Ecology of the riffle insects of the Firehold River, Wyoming. 2129

Arnold, Edgar L., Jr.
Gulf of Mexico plankton investigations: 1951-53. 2393

Arnoult, J., and J. Spillmann.
On some special techniques which facilitate the maintenance and transportation of living aquatic animals. (Sur Quelques Techniques Actuelles Facilitant Le Confinement Et Leetransport D' Animaux Aquatiques Vivants). 2833

Aruga, Y., and S. Ichimura.
Some characteristics of photosynthesis of fresh water phytoplankton. 2483

Arvy, L., M. Gabe, and M. Fontaine.
Modifications in the hypothalamohypophysial Neurosecretory tract in S. Salar during the life cycle. (Modifications de la Voie Neuro-secretrice Hypothalamohypophysaire de Salmo salar L. au Cours du Cycle Evolutif.) 2466

Askerov, M. K., and I. B. Bogatova.
Test on Commercial Cultivation of Daphnia Magna. (Opyt Proizvodstvennogo Kul'tivirovaniia Dafnii). 2711

Askhayev, M. G.
Results of fish acclimatization in the waters of eastern Siberia. (Resul'taty Akklimatizatsii Ryb V Dodoemakh Vostochnoy Sibiri). 2842

Ayers, J. C., D. V. Anderson, D. C. Chandler, and G. H. Lauff.
Currents and water masses of Lake Huron. (1954 synoptic surveys). 2683

Azbelev, V. V., and I. I. Lagunov.
On the condition of the Tuloma salmon stock in connection with the work in the fishery on the Tuloma River. (O Sostoianii Tulomskogo Stada Semgi V Sviazi S Rabotoi Rybokhoda Na Reke Tolume). 2706

Bailey, Reeve M.
A new catostomid fish, Moxostoma (Thoburnia) atripinne, from the Green River Drainage, Kentucky and Tennessee. 2729

Bailey, Robert E.
The effect of estradiol on serum calcium, phosphorus, and protein of goldfish. 2138

Bailey, W. B.
On the Dominant Flow in the Strait of Belle Isle. 2265

Bakkala, Richard G., and Harold A. Gangmark.
Plastic standpipe for sampling streambed environment of salmon spawn. 2187

Bandt, H. J.
Toxic or non-toxic to fish? 2168
Poisoned waters. 2685

Bandt, J. H.
The toxicity of weed-killers to fish. 2679

Bardach, John.
The summer standing crop of fish on a shallow Bermuda reef. 2326
The role of the senses in the feeding of the nocturnal reef predators Gymnothorax moringa and G. vicinus. 2735

Bargetzi, J. P.
Use of biochemical methods of analysis for a taxonomic study: The coregones of the lake of Neuchatel (Application de Methodes d'Analyse Biochimique a Enu Etude Taxonomique: Les Coregones du Lac de Neucha Tel). 2493
Application of a biochemical method of analysis to a taxonomic study: The coregones of Lake Neuchatel. II. Cytology and dosage of DNA. (Application de Methodes D'Analyse Biochimique A Une Etude Taxonomique: Les Coregones Du Lac De Neuchatel. II. Cytologie Et Dosage De DNA). 2635

Barlow, George W.
Daily movements of desert pupfish, Cyprinodon macularius, in shore pools of the Salton Sea, California. 2128

Barnes, Harold, and Margaret Barnes.
Contenuto Di Fosforo Totale In Alcuni Stadi Di Due Comuni Animali Planctonici D'Acqua Dolce E Suo Rapporto Con Quello Delle Loro Uova. 2887

Barnes, Margaret., and Harold Barnes.
Contenuto Di Fosforo Totale In Alcuni Stadi Di Due Comuni Animali Planctonici D' Acqua Dolce E Suo Rapporto Con Quello Delle Loro Uova. 2887

Barrett, M. J., and A. L. H. Gameson.
Oxidation, re-aeration and mixing in the Thames estuary. 2439

Bartsch, A. F., E. C. Tsivoglou, D. E. Rushing, and D. A. Holaday.
Effects of uranium ore refinery wastes on receiving waters. 2429

Basu, Satyendra Prasanna.
Active respiration of fish in relation to ambient concentrations of oxygen and carbon dioxide. 2372

Bauchot, M. L., R. Bauchot, and P. Laubet.
Study of the fish fauna of the basin of Arcachon. (Etude de la Faune Ichthyologique du Bassin D' Arcachon (Gironde)). 2231

Bauchot, R., M. L. Bauchot, and P. Laubet.
Study of the fish fauna of the basin of Arcachon. (Etude de la Faune Ichtyologique du Bassin D' Arcachon (Gironde)). 2231

Beak, T. W.
Toleration of fish to toxic pollution. 2272

Beall, Harvey B., and Richard W. Wahl.
Trapping bluegill sunfish in West Virginia ponds. 2758

Beauchamp, R. S. A.
Utilizing the natural resources of Lake Victoria

for the benefit of fisheries and agriculture. 2164

Beaulieu, G., and Vadim D. Vladykov.
Variations in the annual abundance, in Quebec, of fishes native to the great lakes. (Variations Dans le Quebec de L' Abondance Annuelle des Poissons Originaires des Grands-Lacs). 2601

Beck, William M., Jr.
A study of the interrelations of selected chemical and physical factors in the Suwanee River. 2459

Becker, E. Lovell, Robert Bird, John W. Kelly, John Schilling, Sidney Solomon, and Nelson Young.
Physiology of marine teleosts. I. Ionic composition of tissue. 2357
Physiology of marine teleosts. II. Hematologic observations. 2358

Beeton, Alfred, James H. Johnson, and Stanford H. Smith.
Lake Superior limnological data, 1951-57. 2771

Bennett, Edward B., and Townsend Cromwell.
Surface drift charts for the eastern tropical Pacific Ocean. 2305

Bennett, Hardy J., B. Theodore Cole, and Jack D. Miller.
Tolerance of euryhaline fish forms to dilutions of oil field bleed water. 2504

Benson, Norman G.
Fish management of Wood's Reservoir. 2731

Benson, Norman G., Oliver B. Cope, and Ross V. Bulkley.
Fishery management studies on the Madison River system in yellowstone National Park. 2774

Bentley, William G., Dwight A. Webster, and James P. Galligan.
Management of the lake trout fishery of Cayuga Lake, New York, with special reference to the role of hatchery fish. 2363

Berg, L. S.
Summer and winter races among anadromous fishes. (Yarovye I Ozimye Rasy U Prokhodnykh Ryb). 2886

Berkson, Harold, and David M. Pratt.
Two sources of error in the oxygen light and dark bottle method. 2783

Bernard, F.
La Probleme Biologique De La Fertilite Marine Elementaire. 2592

Berry, Frederick H.
Additions to the fishes known from the vicinity of Cedar Key, Florida. 2494
Young Jack Crevalles (Caranx species) off the south eastern Atlantic Coast of the United States. 2761

Beskrovnyy, A. M., and O. A. Sukacheva.
A histological analysis of the gonads of lake Chudskoye whitefish acclimatized in Khar'kov Oblast basins. (Gistologicheskiy Analiz Gonad Chudskogo Siga Akklimatiziruyemogo V Vodoyemakh Kharkovskoy Oblasti). 2408

Bialkowsky, H. W., and P. S. Billington.
Pilot studies to predict effects of waste on receiving waters. 2218

Bigej, R. G., B. D. Combs, and R. E. Burrows.
The effect of controlled light on the maturation of adult blueback salmon. 2671

Billington, P. S., and H. W. Bialkowsky.
Pilot studies to predict effects of waster on receiving waters. 2218

Bird, Robert, John W. Kelly, John Schilling, Sidney Solomon, Nelson Young, and E. Lovell Becker.
Physiology of marine teleosts. I. Ionic composition of tissue. 2357
Physiology of marine teleosts. II. Hematologic observations. 2358

Bishop, Yvonne M. M., Milner B. Schaefer, and Gerald V. Howard.
Some aspects of upwelling in the Gulf of Panama. 2122
Errors in estimates of mortality obtained from virtual populations, 2365

Bitners, I., and D. R. Idler.
Biochemical studies on sockeye salmon during spawning migration. V. Cholesterol, fat, protein and water in the body of the standard fish. 2373

Bjorklund, Richard Guy.
The biblogical function of the thyroid and the effect of length of day on the growth and maturation of the goldfish Carassius auratus (Linnaeus). 2405

Black, Edgar C.
Hyperactivity as a lethal factor in fish. 2273

Black, Edgar C., and Robert P. Parker.
Muscular fatigue and mortality in troll-caught chinook salmon (Oncorhynchus tshawytscha). 2367

Black, Edgar C., R. R. Parker, and P. A. Larkin.
Fatigue and mortality in troll-caught Pacific salmon (Oncorhynchus). 2883

Black, Edgar C., Wing-Gay Chiu, Francis D. Forbes, and Arthur Hanslip.
Changes in pH, carbonate and lactate of the blood of yearling Kamloops trout, Salmo gairdneri, during and following severe muscular activity. 2880

Blaik, Maurice, John Northrop, and Roberto Frassetto.
Bathymetry of the Gibbs Hill area, Bermuda. 2531

Blair, A. A.
Back-pack fish shocker. 2199

Blazka, P.
The anaerobic metabolism of fish. 2238

Blondeau, R., J. Van Overbeek, and W. J. Hughes.
Acrolein for the control of water weeds and disease-carrying watersnails. 2634

Bogan, R. H.
Biochemical degradation products. A new dimension in stream pollution. 2595

Bogatova, I. B., and M. K. Askerov.
Test on commercial cultivation of Daphnia magna. (Opyt Proizvodstvennogo Kul Tivirovaniia Dafnii). 2711

Bogitsh, Burton J.
Observations on the seasonal occurrence of a

Pseudophyllidean tapeworm infecting the alimentary tract of Lepomis macrochirus macrochirus Raf. in Albermarle County, Virginia. 2125

Bohlke, James E.
Studies on fishes of the family Characidae, No. 16, -- A new Hyphessobrycon from Costa Rica. 2204

Borash, A. J., H. L. Haynes, H. H. Moorefield, and J. W. Keays.
The toxicity of Sevin to goldfish. 2492

Boroughs, H., et al.
The effects of atomic radiation on oceanography and fisheries. Chapter Subject: Laboratory experiments on uptake. 2478

Boyd, W. L.
Limnology of selected arctic lakes in relation to water supply problems. 2911

Breeder, C. M., Jr.
Studies on social groupings in fishes. 2763

Brett, J. R., and D. F. Alderdice.
The resistance of cultured young chum and sockeye salmon to temperatures below 0°C. 2252

Brett, J. R., and M. A. Ali.
Some observations on the structure and photomechanical responses of the Pacific salmon retina. 2253

Brett, J. R., M. Hollands, and D. F. Alderdice.
The effect of temperature on the cruising speed of young sockeye and coho salmon. 2274

Brezner, Jerome.
Food habits of the northern river carpsucker in Missouri. 2175

Bridges, Colton H., Thomas Dolan, and Charles B. Wurtz.
Survey of multiple-use reservoir practices in the United States. 2665

Briggs, John C.
A list of Florida fishes and their distribution. 2495

Briggs, John C., and Nobuo Egami.
The medaka (Oryzias latipes). A commentary and a bibliography. 2655

Briggs, R., G. V. Dyke, and G. Knowles.
Electrical recorder for dissolved oxygen. 2901

Broadhead, Gordon C.
Morphometric comparisions among yellowfin tuna. Neothunnus macropterus, from the eastern tropical Pacific Ocean. 2723

Brockway, D. R., and Arthur M. Phillips, Jr.
Dietary calories and the production of trout in hatcheries. 2380

Brook, A. J., and A. V. Holden.
Fertilization experiments in Scottish freshwater lochs. I. Loch Kinardochy. 2151

Bross, Michel G., and Alfred Houser.
Observations on growth and reproduction of the paddlefish. 2666

Brown, N. L., and B. V Hamon.
A temperature-chlorinity-depth recorder for use at sea. 2689

Brown, W Duane, M. Gumbmann, and A. L. Tappel.
Intermediary metabolism of fishes and other aquatic animals. 2396

Bryson, Reid A., and David B. Clarke.
An investigation of the circulation over Second Point Bar, Lake Mendota. 2538

Bryson, Reid A., and Charles R. Stearns.
A mechanism for the mixing of the waters of Lake Huron and South Bay, Manitoulin Island. 2777

Budd, J. C., and F. E. J. Fry.
The survival of yearling lake trout planted in South Bay, Lake Huron. 2196

Bulkley, Ross V., Norman G. Benson, and Oliver B. Cope.
Fishery management studies on the Madison River system in Yellowstone National Park. 2774

Buller, Raymond J., William F. Royce, and Ernest D. Premetz.
Decline of the yellowtail flounder (Limanda ferruginea). 2697

Bullivant, J. S.
Stomach contents of spawning quinnat salmon. 2732

Bullock, G. L., C. E. Dunbar, and Snieszko, S. F.
Resistance to ulcer disease and furunculosis in eastern brook trout, Salvelinus fontinalis. 2753

Burdick, Milton, Elmer Herman, Warren Wisby, and Lawrence Weigert.
The yellow perch, its life history, ecology, and management. 2376

Burgner, Robert Louis.
A study of fluctuations in abundance, growth, and survival in the early life stages of the red salmon (Oncorhynchus nerka Walbaum) of the Wood River Lakes, Bristol Bay, Alaska. 2247

Burnashev, M. S., V. S. Chepurnov, and V. N. Dolgiy.
Data on the composition and distribution of summer zooplankton in the Burnas and Alibey estuaries (Svedeniya O Sostave I Raspredelenii Letnego Zooplanktona V Limanakh Burnas I Alibey). 2420

Burnet, A. M. R.
Electric fishing with pulsatory direct current. 2640

Burrows, R. E., B. D. Combs, and R. G. Bigej.
The effect of controlled light on the maturation of adult blueback salmon. 2671

Burt, Wayne V.
Oxygen anomalies in the surf near Coos Bay, Oregon. 2523

Buscemi, Philip A.
Littoral oxygen depletion produced by a cover of Elodea canadensis. 2596

Buss, Keen.
Trout and trout hatcheries of the future. 2859
Jar culture of trout eggs. 2383

Butskaia, N. A.
Experimental facts on sturgeon breeding on the Agrakhan Gulf. (Eksperimental'nye Obosnovaniia Osetroodstva Na Agrakhanskom Zalive). 2700

Cachon, Jean.
Some technics for collecting plankton for bio-

logical investigation. (Sur Quelques Techniques de Peches Planctoniques pour Etudes Biologiques). 2499

Cairns, J., and A. Scheier.
The effects of periodic low oxygen upon the toxicity of various chemicals to aquatic organisms. 2445

Campbell, H. J.
Field testing rotary fish screens in northeastern Oregon. 2670

Campbell, Robert S., and Arthur Witt. Jr.
Refinements of equipment and procedures in electrofishing. 2663

Canagaratnam, P.
Growth of fishes in different salinities. 2369

Carlander, Kenneth D.
Some simple mathematical models as aids in interpreting the effect of fishing. 2205
A survey of technical fishery personnel. 2661

Carritt, D., and J. Harley.
The effects of atomic radiation on oceanography and fisheries. Chapter Subject: Precipitation on the ocean bottom. 2478

Carritt, D. E., and J. W. Kanwisher.
An electrode system for measuring dissolved oxygen. 2687

Cassie, R. Morrison.
Apparatus for investigating spatial distribution of plankton. 2500

Cervenka, R.
Electrochemical determination of oxygen in waters. 2426

Cervenka, R., and M. Korbova.
Synchronized determination of pH. Alkalinity, Calcium and Magnesium. 2424

Chakrabarty, R. D., P. Roy, and S. B. Singh.
A quantitative study of the plankton and the physico-chemical conditions of the river Jumna at Allahabad in 1954-55. 2895

Chakravarty, S. K., K. C. Saha, D. P. Sen, and A. K. Roy Chowdhury.
Studies on the factors influencing spawning of Indian major carps in "Bundh" fisheries. 2511

Chancellor, A. P.
The control of aquatic weeds and algae. 2427

Chandler, D. C., J. C. Ayers, D. V. Anderson, and G. H. Lauff.
Currents and water masses of Lake Huron. (1954 synoptic surveys). 2683

Chapman, Douglas G.
The analysis of a catch curve. 2745

Chatwin, Bruce M.
The relationships between length and weight of yellowfin tuna (Neothunnus macropterus) and skipjack tuna (Katsuwonus pelamis) from the eastern tropical Pacific Ocean. 2722

Chepurnov, V. S., M. S. Burnashev, and V. N. Dolgiy.
Data on the composition and distribution of summer zooplankton in the Burnas and Alibey estuaries (Svedeniya O Sostave I Raspredelenii Letnego Zooplanktona V Limanakh Burnas I Alibey). 2420

Chiba, T., and T. Hoshina.
On the bacteriostatic power of malachite green against the causative bacteria of vibrio-disease of rainbow trout. 2623

Chigusa, Masanori, Masuo Takase, and Makoto Hirose.
Detection of the withered tree below the surface by the ultrasonic echo sounder. 2608

Chin, Edward.
An inexpensive re-circulating sea-water system. 2677

Chipman, Robert K.
Studies of tolerance of certain freshwater fishes to brine water from oil wells. 2524

Chiu, Wing-Gay., Edgar C. Black, Francis D. Forbes, and Arthur Hanslip.
Changes in pH, carbonate and lactate of the blood of yearling kamloops trout, Salmo gairdneri, during and following severe muscular activity. 2880

Chizhova, T. P.
Diphllobothriasis in the Kaliningrad District. (O Difillobotrioze Kaliningradskoi oblasti.) 2206

Chobot, M., L. Musiał, L. Turoboyski, and W. Labuz.
Investigations on contamination of the Soła River and its self purification capabilities. (Badania Nad Zanieczyszczeniem Rzeki Soły I Jej Zdolnoscia Samooczyszczania.) 2618

Chowdhury, A. K. Roy, K. C. Saha, D. P. Sen, and S. K. Chakravarty.
Studies on the factors influencing spawning of Indian major carps in "Bundh" fisheries. 2511

Chuman, Michio
Fundamental studies on the relation of underwater sound to the fish behavior. (I) About the sounds by dropping or showering. 2588

Chur, Sung Pal, and Julius Rockwell Jr.
An underwater observation chamber. 2756

Churchill, M. A.
Effects of impoundments on oxygen resources. 2441

Churchill, Warren, Wallace Niemuth, and Thomas Wirth.
The walleye, its life history, ecology and management. 2377

Clark, Eugenie.
Functional hermaphroditism and self-fertilization in a Serranid fish. 2296

Clarke, David B., and Reid A. Bryson.
An investigation of the circulation over Second Point Bar, Lake Mendota. 2538

Claussen, L. G.
A southern range extension of the American shad to Todos Santos Bay, Baja California, Mexico. 2894

Clemens, H. P., and Kermit E. Sneed.
Effect of temperature and physiological condition on tolerance channel catfish to Pyridylmercuric acetate (PMA) 2170
The use of human chorionic gonadotrophin to spawn warm-water fishes. 2754

Cocking, Anthony W.
The effects of high temperatures on roach (Rutilus rutilus). 1. The effects of constant

high temperatures. 2342
The effects of high temperatures on roach (Rutilus rutilus). II. The effects of temperature increasing at a known constant rate. 2344
Cohen, J. M., C. Henderson, and Q. H. Pickering.
The toxicity of synthetic detergents and soaps to fish. 2916
Cole, B. Theodore, Hardy J. Bennett, and Jack D. Miller.
Tolerance of Euryhaline fish forms to dilutions of oil field bleed water. 2504
Cole, Vernon W., and William M. Lewis.
The removal of residual chlorine from tap water that is to be used in aquaria. 2477
Coleman. P. G.
The chemical control of water hyacinth in Kelantan. 2207
Collette, Bruce B., and Robert H. Gibbs.
On the identification, distribution, and biology of the dolphins, Coryphaena hippurus and C. equiselis. 2746
Collier, Albert.
Gulf of Mexico physical and chemical data from Alaska cruises. 2403
Combs, B. D., R. E. Burrows, and R. G. Bigej.
The effect of controlled light on the maturation of adult blueback salmon. 2671
Comita, G. W., and G. C. Anderson.
The seasonal development of a population of Diaptomus ashlandi Marsh, and related phytoplankton cycles in Lake Washington. 2330
Cope, Oliver B., Norman G. Benson, and Ross V. Bulkley.
Fishery management studies on the Madison River system in Yellowstone National Park. 2774
Corbella, Carla.
Plancton, Bentos E. Chimismo Delle Acque E Cei Secimenti In Un Lago Profondo (Lago Maggiore). IV. Caratteristiche Chimiche Dell' Acqua E Dei Sedimenti. 2888
Cordone, Almo J., Leo Shapovalov, and William A. Dill.
A revised check list of the freshwater and anadromous fishes of California. 2892
Craddock, Donovan R.
Spawning excapement of Okanogan River blueback salmon (Oncorhynchus nerka), 1957. 2192
A modified fyke net for the live capture of seaward-migrating salmon. 2388
Craig, H.
The effects of atomic radiation on oceanography and fisheries. Chapter Subject: Disposal of radioactive wastes in the sea, effects of time and mixing characteristics. 2478
The effects of atomic radiation on oceanography and fisheries. Chapter Subject: Trace studies of the sea and atmosphere. 2478
Crandall, Catherine Ann, and Clarence J. Goodnight.
The effect of various factors on the toxicity of sodium pentachlorophenate to fish. 2331
Creelman, Vera M., and Neil Tomlinson.
Biochemical studies on sockeye salmon during spawning migration. VI. Ribonucleic acid and deoxyribonucleic acid. 2882
Crittenden, Edward, John D. Kilby, and Lovett E. Williams.
Several fishes new to Florida freshwaters. 2299
Cromwell, Townsend.
Thermocline topography, horizontal currents and "Ridging" in the eastern tropical Pacific. 2121
Cromwell, Townsend, and Edward B. Bennett.
Surface drift charts for the eastern tropical Pacific Ocean. 2305
Crossman, E. J.
Distribution and movements of a predator, the rainbow trout, and its prey, the redside shiner, in Paul Lake, British Columbia. 2649
A predator-prey interaction in freshwater fish. 2650
Crossman, E. J., and P. A. Larkin.
Yearling liberations and change of food as affecting rainbow trout yield in Paul Lake, British Columbia. 2664
Crouter, R. A., and E. H. Vernon.
Effects of black-headed budworm control of salmon and trout in British Columbia. 2392
Curl, Herbert, Jr.
The origin and distribution of phosphorus in western lake Erie. 2328
Curry-Lindahl, Kai.
The occurrence of the Char, Salmo alpinus, in running waters in arctic and high boreal areas in Sweden. 2816
Curtis, Brian.
Changes in a river's physical characteristics under substantial reductions in flow due to hydroelectric diversion 2893

Dam, Levie Van, and Per Fredrik Scholander.
Micro gasometric determination of oxygen in fish blood. 2851
Dam, Levie Van, Per Fredrik Scholander, John Willis Kanwisher, Harold Theodore Hammel, and Malcolm Stephen Gordon.
Supercooling and osmoregulation in arctic fish. 2833
Danil'Chenko, O. P.
Penetration of radioactive strontium-90 from the water into the body of the fish. (Proniknovenie Radio-Aktivnogo Strontsiia-90 Is Vody V Organizm Ryby) 2701
Dappert, A. F.
The use of stream data in administration of pollution abatement programmes. 2434
Das, B. C.
Comparative effects of vitamin B_{12}, cobalt nitrate and ruminant stomach extract on the survival rate of Indian carp during the first three weeks of life. 2897
Daum, M., and J. R. Salvesen.
Turbine aeration as a method of increasing the purification capacity of a stream. 2905
Davies, D. H.
The biology of the South African pilchard.

(Sardinops ocellata). 2245
Davis A., and M. P. Motwani.
Fishes of the River Sone with observations on the zoogeographical significance. 2126
Davis, D. S.
Oxygen dissolved in water. 2452
Davis, D. S., and H. C. Ways.
Solubility and percentage saturation of oxygen in water. 2904
Davis, J. J. Hanford, and D. G. Watson.
Concentration of radio-isotopes in Columbia River whitefish in the vicinity of the Hanford Atomic Products Operation. 2921
Dawson, C. E.
A study of the biology and life history of the spot Leiostomus zanthurus Lacapede, with special reference to South Carolina. 2580
Day, Alan A.
The continental margin between Brittany and Ireland. 2530
Day, Albert M., and Milo Moore.
A review of the Japanese salmon fishery. 2698
Day, C. Godfrey.
Surface circulation in the Gulf of Maine as deduced from drift bottles. 2183
Oceanographic observations, 1957, east coast of the United States. 2695
Day, L. R., and A. H. Leim.
Records of uncommon and unusual fishes from eastern Canadian waters, 1950-1958. 2885
de Buen, Fernando.
Ichthyology: The family ictaluridae new to the Acclimated fauna of Chile and some considerations on the indigenous Siluroidei. (Ictiologia: la familia Ictaluridae nueva para la fauna aclimatada de Chile y algunas consideraciones sobre los Siluroidei indegenas). 2496
Deelder, C. L.
Modern fish passes in the Netherlands. 2172
Deeva, T. A
Using green aquatic plants as addition to food for the year's crop. (Primenenie zelenoi vodnoi rastitel' nosti kak dobavok k kormam pri vyrashchivanii segoletkov). 2702
de Godoy, M. P.
Tolerance of euryhaline fish forms to dilutions of oil field bleed water. 2505
Deiler, Frederick G.
Vegetation management of storage water reservoirs at Garden Island Bay. 2480
De Kock, L. L., and S. Symmons.
A ligament in the dorsal aorta of certain fishes. 2747
Dence, Wilford A.
Studies on ligula-infested common shiners (Notropis cornutus frontalis Agassiz) in the Adirondacks. 2472
Desmarais, Yves.
Comparison of growth and feeding of speckled trout from Laurentides Park and Rimouski. (Croissance et alimentation comparee de la truite du parc des laurentides et de rimouski). 2598
Fecundity and growth of the trout (Salvelinus fontinalis) in three lakes of the Laurentides Park. (Fecondite et croissance de la truite (Salvelinus fontinalis) dans trois lacs du parc des laurentides. 2617
de Sylva, Donald Perrin.
The life history and systematics of the great barracuda, Sphyraena barracuda (Walbaum). 2647
Deufel, J.
The ecology of some types of Pseudomonas in the upper lake of lake Constance. 2451
Devantoy, Jean.
Fishes of the Belfort Region. (Les Poissons de la Region de Belfort). 2224
Dill, William A., Leo Shapovalov, and Almo J. Cordone.
A revised check list of the freshwater and anadromous fishes of California. 2892
Dinsmore, Bruce Heasley.
Ecological studies of twelve strip mine ponds in Clarion County, Pennsylvania. 2406
Dodimead, A. J., and H. J. Hollister.
Progress report of drift bottle releases in the northeast Pacific Ocean. 2254
Doi, Takeyuki.
Dynamical treatment of expoitation of aquatic resource. II. Effect on the aspect of appearance of recruit by the feedback of information of the size of stock. 2581
Dolan, Thomas, Charles B. Wurtz, and Colton H. Bridges.
Survey of multiple-use reservoir practices in the United States. 2665
Dolgiy, V. N., V. S. Chepurnov, and M. S. Burnashev.
Data on the composition and distribution of summer zooplankton in the Burnas and Alibey estuaries (Svedeniya o sostave i raspredelenii letnego zooplanktona v limanakh burnas i Alibey). 2420
Domurat, J.
Embryonic development of trout (Salmo trutta L.). pike (Esox Lucius L.), and roach (Rutilus rutilus L.) in an environment deprived of water (Rozwoj embrionalny troci (Salmo trutta L.), szczupaka (Esox lucius L.) o ploci (Rutilus rutilus L.) w srodowisku bezwodnym). 2521
Donaldson, John R., Lauren R. Donaldson, and Paul R. Olson.
The Fern Lake trace mineral metabolism program. 2659
Donaldson, Lauren R., Paul R. Olson, and John R. Donaldson.
The Fern Lake trace mineral metabolism program. 2659
Donaldson, L. and R. Foster.
The effects of atomic radiation of oceanography and fisheries. Chapter Subject: Radiation of aquatic organisms. 2478
Doudoroff, P., and C. E. Warren.
The development of methods for using bioassays in the control of pulp mill waste disposal. 2449
Drewry, George E., and Clark Hubbs.

Long duration of sperm function in two euryhaline fishes and its lack of significance in hybridization. 2123

Dubrovskiy, N. V.
Zoobenthos in fish ponds on the collective farm Imeni Stalin in the Bogodukhov Rayon (Zoobentos rybovodnykh prudov kolkhoza im. Stalina Bogodukhovskogo rayona). 2419

Dunbar, C. E., and Ken Wolf.
Methods of infecting trout with kidney disease and some effects of temperature on experimental infections. 2394
Test of 34 therapeutic agents for control of kidney disease in trout. 2866

Dunbar, C. E., S. F. Snieszko, and G. L. Bullock.
Resistance to ulcer disease and furunculosis in eastern brook trout, Salvelinus fontinalis. 2753

Duncan, D. W., and H. L. A. Tarr.
Biochemical studies on sockeye salmon during spawning migration. III. Changes in the protein and non-protein nitrogen fractions in muscles of migrating sockeye salmon. 2463

Dvinin, P. A.
New data on the migration of humpback salmon in the Sakhalin region. (Novye Dannye O Migratsiiakh Gorbushi, Oncorhynchus gorbuscha Walbaum, V Raione Sakhalina). 2703

Dyke, G. V., R. Briggs, and G. Knowles.
Electrical recorder for dissolved oxygen. 2901

Dziekonska, J.
Studies on embryonic development of fish. I. Observations on the spawning and the embryonic development of bream in the Vistula Lagoon (Badania Nad Wczesnymi Stadiami Rozwojowymi Ryb. I. Rozrod I Rozwoj Embrionalny Leszcza (Abramis brama L.) W Zalewie Wislanym). 2506

Ebbinghaus, E.
Apparatus for recording the oxygen content of waste waters. 2684

Egami, Nobuo, and John C. Briggs.
The medaka (Oryzias latipes). A commentary and a bibliography. 2655

Eipper, Alfred W.
Effects of five herbicides on farm pond plants and fish. 2643

Elling, Carl H., and Howard L. Raymond.
Fishway capacity experiment, 1956. 2768

Ellis, C. H., and R. E. Noble.
Calculated minimum contributions of Washington's hatchery releases to the catch of salmon on the Pacific Coast and the costs assessable to hatchery operations. 2879

El-Zarka, Salah El-Din.
Fluctuations in the population of yellow perch, Perca flavescens (Mitchill), in Saginaw Bay, Lake Huron. 2760

Enami, Sumio, and Toyotaka Tanoue.
On the fisheries of tuna and the oceanographical conditions in the Sawu Sea. 2558

Endo, T., K. Tabata, and Y. Matsue.
Effect of an insecticide, parathion, on aquatic animals at lower ranges than its lethal concentration. 2820

Erasmus, David A.
The migration of Cercaria x baylis (Strigeida) within the fish intermediate host. 2319

Eschmeyer, P. H.
Survival and retention of tags, and growth of tagged lake trout in a rearing pond. 2381

Ettinger, M. B., F. J. Ludzack, and W. M. Ingram.
Characteristics of a stream composed of oil refinery activated sludge effluents. 2553

Ettinger, M. B., W. M. Ingram, P. W. Kabler, M. Katz, F. W. Kittrell, R. Porges, C. M. Tarzwell, W. W. Towne, E. C. Tsivoglou, and R. L. Woodward.
A critical review of the literature of 1957 on water pollution. 2400

Evans, John E., and George A. Rounsefell.
Large-scale experimental test of copper sulfate as a control for the Florida red tide. 2193

Evans, Willis A., Orthello L. Wallis, and Glenn D. Gallison.
Fishes of Yosemite. 2294

Fabricius, Eric, and Karl-Jacob Gustafson.
Some new observations on the spawning behaviour of the pike, Esox lucius L. 2291

Faegri, Knut.
A practical suggestion for diatom preparations. 2498

Faktorovich, K. A.
Diseases of two-year-old rainbow trout reared on artificial foods. (Zabolevaniia dvukhletok raduzhnoi foreli pri vyrashchivanii na iskusstvennykh kormakh). 2704

Farris, David A.
A change in the early growth rates of four larval marine fishes. 2329

Farrugia, G., and M. Lefevre.
The effect on fresh-water algae of the products of natural decomposition of organic substances of animal and plant origin. 2150

Ferguson, R. G.
The preferred temperature of fish and their midsummer distribution in temperate lakes and streams. 2275

Filice, Francis P.
Invertebrates from the estuarine portion of San Francisco Bay and some factors influencing their distributions. 2528

Fish, G. R.
Chemical factors limiting growth of phytoplankton in lake Victoria. 2481

Fish, Marie Poland, and William H. Mowbray.
The production of under-water sound by Opsanus Sp., A new toad-fish from Bimini, Bahamas. 2737

Fisk, Leonard O.
Experiments with a vertical baffle fishway. 2642

Fitch, John E.
Offshore fishes of California. 2856

Fitzgerald, G. P.
The control of the growth of algae with CMU. 2160

Folsom, T., and A. Vine.
The effects of atomic radiation on oceanography and fisheries. Chapter Subject: Tagged water masses for studying the oceans. 2478

Folsom, T., and J. Harley.
The effects of atomic radiation on oceanography and fisheries. Chapter Subject: Natural radiation of selected organisms. 2478

Folsom, T. R., F. D. Jennings, and R. A. Schwartzlose.
Effect of pressure upon the "Protected" oceanographic reversing thermometer. 2533

Fontaine, M., L. Arvy, and M. Gabe.
Modifications in the hypothalamohypophysial neurosecretory tract in S. salar during the life cycle. (Modifications de la Voie Neuro-Secretrice Hypothalamohypophysaire de Salmo salar L. au Cours du Cycle Evolutif). 2466

Forbes, Francis D., Edgar C. Black, Wing-Gay Chiu, and Arthur Hanslip.
Changes in pH, carbonate and lactate of the blood of yearling Kamloops trout, Salmo gairdneri, during and following severe muscular activity. 2880

Fortune, P. Y.
The effect of temperature changes on the thyroid-pituitary relationship in teleosts. 2585

Foskett, D. R.
The rivers inlet sockeye salmon. 2255

Foster, R., and L. Donaldson.
The effects of atomic radiation on oceanography and fisheries. Chapter Subject: Radiation of aquatic organisms. 2478

Foster, R., and L. Krumholz.
The effects of atomic radiation on oceanography and fisheries. Chapter Subject: Uptake by fresh water organisms. 2478

Francois, Y.
Several problems on the dorsal fin of teleosts. (Quelques Problemes Relatifs a la Negeoire Dorsale des Teleosteens). 2576

Franklin, Donald R., Lloyd L. Smith, Jr., and Robert H. Kramer.
Development of quantitative sampling methods for young of the year fish. 2203
Electro-fishing for small fish in lakes. 2872

Frassetto, Roberto, John Northrop, and Maurice Blaik.
Bathymetry of the Gibbs Hill Area, Bermuda. 2531

Freeman, Harry W., and William D. Anderson.
Fishes of the Congaree River drainage, South Carolina. 2244

Freier, R., and F. Todt.
Electrochemical measurement of dissolved oxygen in water. 2902

Freier, R., and G. Resch.
Determination of dissolved oxygen in water. 2925

French, Robert R., and Roy J. Wahle.
Biology of chinook and blueback salmon and steelhead in the Wenatchee River system. 2772

Frey, D. G., and J. B. Stahl.
Measurements of primary production on Southampton Island in the Canadian Artic. 2282

Fromm, Paul Oliver, and Ezra Paul Reineke.
Some aspects of thyroid physiology in rainbow trout. 2830

Fromm, Paul Oliver, and R. H. Schiffman.
Chromium-induced changes in the blood of rainbow trout, Salmo gairdnerii. 2918
Measurement of some physiological parameters in rainbow trout (Salmo gairdnerii). 2333

Fry, F. E. J.
The lethal temperature as a tool in taxonomy. 2656

Fry, F. E. J., and E. T. Garside.
A possible relationship between yolk size and differentiation in trout embryos. 2742

Fry, F. E. J., and J. C. Budd.
The survival of yearling lake trout planted in South Bay, Lake Huron, 2196

Fujii, Takeji, and Hideto Koto.
Structure of the waters in the Bering Sea and the Aleutian Region. 2144

Fukano, K. G., and F. F. Hooper.
Toxaphene (Chlorinated camphene) as a selective fish poison. 2180

Gabe, M., L. Arvy, and M. Fontaine.
Modifications in the hypothalamohypophysial neurosecretory tract in S. salar during the life cycle. (Modifications de la Voie Neuro-Secretrice Hypothalamohypophysaire de Salmo salar L. au Cours du Cycle Evolutif). 2466

Galina, N. V., E. F. Martinson, and V. IA. Redikson.
On the biotechnique in artificial breeding of pike. (O biotekhnike Iskusstvennogo Razvedeniia Shchuki.) 2705

Galligan, James P., Dwight A. Webster, and William G. Bentley.
Management of the lake trout fishery of Cayuga Lake, New York, with special reference to the role of hatchery fish. 2363

Gallison, Glenn D., Willis A. Evans, and Orthello L. Wallis.
Fishes of Yosemite. 2294

Gameson, A. L. H., and M. J. Barrett.
Oxidation, re-aeration and mixing in the Thames estuary. 2439

Ganapati, P. N., and K. Srinivasa Rao.
On the bionomics of Sardinella gibbosa (BLKR) off Waltair coast. 2132

Gangmark, Harold A., and Richard G. Bakkala.
Plastic standpipe for sampling streambed environment of salmon spawn. 2187

Gaponenko, V. I., G. G. Vinberg, and T. N. Godnev.
The experimental use of radioactive phosphorus in the study of pond fertilization (Opyt Primeneniya Radioizotopa Fosfora Pri Izuchenii Udobreniya Prodov). 2236

Garside, E. T., and F. E. J. Fry.
A possible relationship between yolk size and differentiation in trout embryos. 2742

Gaufin, Arden R.
Production of bottom fauna in the Provo River Utah. 2791

The effects of pollution on a midwestern stream. 2907

Gauld, D. T.
Swimming and feeding in crustacean larvae: The nauplius larva. 2335

Gehringer, Jack W.
Early development and metamorphosis of the tenpounder (Elops saurus Linnaeus). 2765

Gehringer, Jack W., and William W. Anderson.
Physical oceanographic, biological and chemical data--south Atlantic coast of the United States. M/V Theodore N. Gill Cruise 6. 2288

Gerking, Shelby D.
The restricted movement of fish populations. 2525

Gibbs, Robert H. Jr., and Bruce B. Collette.
On the identification, distribution, and biology of the dolphins, Coryphaena hippurus and C. equiselis'. 2746

Gibor, Ahron.
A simple technique used for laboratory hatching and rearing of fish. 2177

Gilmour, A. E.
The suspended plummet method for density measurements. 2501

Godfrey, H.
Comparisons of the index of return for several stocks of British Columbia salmon to study variations in survival. 2256
Variations in annual average weights of British Columbia pink salmon, 1944-1958. 2654

Godnev, T. N., G. G. Vinberg, and V. I. Gaponenko.
The experimental use of radioactive phosphorus in the study of pond fertilization. (Opyt Primeneniya Radioizotopa Fosfora Pri Izuchenii Udobreniya Prodov). 2236

Goodnight, Clarence J., and Catherine Ann Crandall.
The effect of various factors on the toxicity of sodium pentachlorophenate to fish. 2331

Gordon, Malcolm Stephen.
Ionic regulation in the brown trout. (Salmo trutta L.) 2715
Osmotic and ionic regulation in scottish brown trout and sea trout (Salmo trutta L.) 2716

Gordon, Malcolm Stephen, Per Fredrik Scholander, L. van Dam, John Willis Kanwisher, and Harold Theodore Hammel.
Supercooling and osmoregulation in arctic fish. 2832

Goss, Richard Johnson.
The effect of x-rays on taste barbel regeneration in the catfish, Ameiurus. 2616

Goss, Richard J., and Martha W. Stagg.
The regeneration of fins and fin rays in Fundulus heteroclitus. 2137

Graham, D. W.
pH-alkalinity. 2899

Grainger, E. H.
The annual oceanographic cycle at Iglooslik in the Canadian Arctic. I. The zooplankton and physical and chemical observations. 2884

Grainger, E. H., and J. G. Hunter.
Station list of the 1955-58 field investigations of the Arctic unit of the fisheries research board of Canada, "CALANUS" SERIES No. 19. 2881

Grainger, J. N. R.
The identity of the larval nematodes found in the body muscles of the cod (Gadus callarias L.) 2321

Grant, Norman, and Anatole S. Loukashkin.
Behavior and reactions of the Pacific sardine, Sardinops caerulea (Girard) under the influence of white and colored lights and darkness. 2658

Green, G. H., and F. J. Andrew.
Sockeye and pink salmon investigations at the Seton Creek hydroelectric installation. 2503

Green, W. C., I. E. Wallen, and R. Lasater.
Toxicity to Gambusia affinis of certain pure chemicals in turbid waters. 2462

Greenbank, John, and Philip R. Nelson.
Life history of the threespine stickleback Gasterosteus aculeatus Linnaeus in Karluk Lake and Bare Lake, Kodiak Island, Alaska. 2693

Greene, M. W., and R. W. Negus.
Method of measuring and recording of small concentrations of oxygen dissolved in water. 2926

Greenwald, Margaret.
List of references on control of aquatic plants, including algae. 2475
Supplement to the list of references on control of aquatic plants, including algae. 2476

Griffiths, V. S., and M. I. Jackman.
Automatic potentiometric, titration in determination of dissolved oxygen. 2688

Grundy, F.
The use of cetyl alcohol in solution to reduce evaporation from reservoirs. Report on an experiment on Malya Reservoir in Tanganyika Territory, in August, 1957. 2148

Guenther, Raymond W., S. W. Watson, and R. R. Rucker.
Etiology of sockeye salmon "Virus" disease. 2404

Gumbmann, M., W. Duane Brown, and A. L. Tappel.
Intermediary metabolism of fishes and other aquatic animals. 2396

Gustafson, Karl-Jacob, and Eric Fabricius.
Some new observations on the spawning behaviour of the pike, Esox lucius L. 2291

Hagelin, L-O.
Notes on the spawning habits of the river Lamprey (Petromyzon fluviatilis). 2605

Haggqvist, G., and G. Hevesy.
The combined effect of heavy water and roentgen irradiation on the animal organism. 2457

Haley, James, A., and Howard E. Winn.
Observations on a lernaean parasite of freshwater fishes. 2868

Halicki, Phillip J.
A comparison of two methods of determining transparency in natural waters. 2574

Hallam, J. C.
Habitat and associated fauna of four species of

fish in Ontario streams. 2371

Halver, John E.
Nutrition of salmonoid fishes. IV. An amino acid test diet for chinook salmon. 2851

Hammel, Harold Theodore, Per Fredrik Scholander, L. van Dam, John Willis Kanwisher, and Malcolm Stephen Gordon.
Supercooling and osmoregulation in Arctic fish. 2832

Hamon, B. V
The effect of pressure on the electrical conductivity of sea-water. 2838

Hamon, B. V., and N. L. Brown.
A temperature-chlorinity-depth recorder for use at sea. 2689

Hanavan, Mitchell G., and George K. Tanonaka.
Experimental fishing to determine distribution of salmon in the North Pacific Ocean and Bering sea. 2770

Hancock, Charles D., Jr., and James E. Sublette.
A survey of the fishes in the Upper Kisatchie drainage of west central Louisiana, 1958. 2565

Hane, S., and O. H. Robertson.
Changes in plasma 17-hydroxycorticosteroids accompanying sexual maturation and spawning of the Pacific salmon (Oncorhynchus tschawytscha). 2751

Haney, P. D., and J. Schmidt.
Representative sampling and analytical methods in stream studies. 2442

Hansen, V. Kr., and E. Steemann Nielsen.
Measurements with the carbon-14 technique of the respiration rates in natural populations of phytoplankton. 2348

Hanslip, Arthur, Edgar C. Black, Wing-Gay Chiu, and Francis D. Forbes.
Changes in pH. carbonate and lactate of the blood yearling kamloops trout, Salmo gairdneri, during and following severe muscular activity. 2880

Hanson, Harley.
Operation fish rescue. 2179

Hanyu, I., K. Iyatomi, T. Tamura, Y. Itazawa, and S. Sugiura.
Toxicity of Endrin to fish. 2173

Harley, J., and D. Carritt.
The effects of atomic radiation on oceanography and fisheries. Chapter Subject: Precipitation on the ocean bottom. 2478

Harley, J., and T. Folsom.
The effects of atomic radiation on oceanography and fisheries. Chapter Subject: Natural radiation of selected organisms. 2478

Harmic, Jay L.
Some aspects of the development and ecology of the pelagic phase of the Gray Squeteague, Cynoscion regalis (Bloch and Schneider) in the Delaware Estuary. 2249

Harris, Patricia J.
A study of thyroid function in Fundulus heteroclitus. 2733

Hart, C. W. Jr.
The ostracods of the genus Entocythere from the lower Chattahoochee-Flint Basin: With a review of the occurrence of the genus in Florida, and descriptions of two new species. 2535

Hart, C. W. Jr., and Horton H. Hobbs.
The freshwater decapod crustaceans of the Apalachicola drainage system in Florida, southern Alabama, and Georgia. 2534

Hart, J. L.
Some sociological effects of quota control of fisheries. 2286

Hashimoto, Kanehisa, and Fumio Matsuura.
Comparative studies on two hemoglobins of salmon. 2306
Multiple hemoglobins in fish. 2307

Hasler, Arthur D., and Richard A. Parker.
Movements of some displaced Centrarchids. 2303

Hatanaka, Masayoshi, Masao Takahashi, and Goro Murakawa.
Experimental studies on the feeding habits of amberfish, Seriola quinqueradiata T and S. 2313

Haven, Dexter S.
Migration of the croaker, Micropogon undulatus. 2301

Hayashi, Ichiro.
Preserving effect of copper naphthenate for fishing nets. 2726
Effect of tar acids on synthetic fibre fishing twine. 2727

Hayashi, Shigeichi.
A note on scales of pink salmon. 2507

Hayasi, Toru, and Hisao Kobayasi.
Preliminary studies on scale arrangement of Japanese fishes. 2312

Hayes, F. R., and E. H. Anthony.
Lake water and sediment. VI. the standing crop of bacteria in lake sediments and its place in the classification of lakes. 2781

Hayes, F. R., and M. A. MacAulay.
Lake water and sediment V. Oxygen consumed in water over sediment cores. 2780

Haynes, H. L., H. H. Moorefield, A. J. Borash, and J. W. Keays.
The toxicity of Sevin to goldfish. 2482

Healy, M. J. R., and F. B. Leech.
The analysis of experiments on growth rate. 2314

Hefetz, A., and A. Yashouv.
A key to the Tilapia species found in pond areas. 2739

Henderson, C., Q. H. Pickering, and C. M. Tarzwell.
Relative toxicity of ten chlorinated hydrocarbon insecticides to four species of fish. 2662

Henderson, C., Q. H. Pickering, and J. M. Cohen.
The toxicity of synthetic detergents and soaps to fish. 2916

Hennemuth, Richard C.
Morphometric comparison of skipjack from the central and eastern tropical Pacific Ocean. 2728

Hepher, B.
The effect of various fertilizers and the methods of their application on the fixation of phosphorus

added to fishponds. 2135
On the dynamics of phosphorus added to fish ponds in Israel. 2136
Herbert, D. W. M., and H. T. Mann.
The tolerance of some fresh-water fish for sea water. 2159
Herman, Elmer, Warren Wisby, Lawrence Wiegert, and Milton Burdick.
The yellow perch, its life history, ecology and management. 2376
Herrera, Juan.
Climatic data of the Harbour of Castellon and thermic data in relation to fishing 1957. (Datos Climaticos del Puerto de Castellon y Termicos de las Aguas Costeras en Relacion con la Pesca en 1957. 2839
Hesselholt, M. N., and J. R. Uzmann.
Teratological hermaphroditism in the chum salmon, Oncorhynchus keta (Walbaum) 2181
Hevesy, G., and G. Haggqvist.
The combined effect of heavy water and roentgen irradiation on the animal organism. 2457
Hewson, L. C.
A seven-year study of the fishery for lake whitefish, Coregonus clupeaformis, on Lake Winnipeg. 2368
A study of six winter seasons of commercial fishing on Lake Winnipeg, 1950-1955. 2370
Hibiya, T., and M. Oguri.
Studies on the adrenal gland of teleosts-II. On the adrenal tissues in 15 species of fishes-II. (In Japanese with English summ). 2630
Hickman, Cleveland P. Jr.
The larval development of the sand sole (Psettichthys melanostictus). 2875
Hicks, Steacy D.
The physical oceanography of Narragansett Bay. 2782
Hideomi, Tuge, and Hidemasa Ochiai.
Studies of the conditioned reflex in the lower vertebrates. II. Early development of the defensive conditioned reactions in fish larvae. 2468
Hikida, Toyohiko.
A preliminary list of fishes from north Pacific Ocean. 2246
Hildebrand, Henry H.
Preliminary biological studies on la laguna madre de tamulipas. (Estudios Biologicos Preliminares Sobre la Laguna Madre de Tamaulipas. 2819
Hilsenhoff, William.
The evaluation of insecticides for the control of Tendipes plumonsus (Linnaeus). 2805
Hirata, Hachiro, and Shinjiro Kobayashi.
Diurnal rhythm of the feeding activity of goldfish in autumn and early winter. 2519
Hirayama, N.
On the school of yellow-fin tuna, Neothunnus rarus (K.), deduced from the distribution of catch on tuna long line. 2797
Hirose, Makoto, Masanori Chigusa, and Masuo Takase.
Detection of the withered tree below the surface by the ultrasonic echo sounder. 2608
Hirsch, Allan.
Biological evaluation of organic pollution of New Zealand streams. 2597
Hiyama, Y., K. Kondo, and T. Kusaka.
Differences on the frequency of fishes among several kinds of colors for under-water fencing net. 2621
Difference on the frequency of transfer of fishes with different degrees of inclinations of underwater fencing net. 2622
Hiyama, Y., and K. Kurogane.
Morphometric comparion of the yellowfin tuna taken from the equatorial Pacific. 2807
Morphometric comparison of the yellowfin tuna from six grounds in the Indian Ocean. 2857
Hiyama, Y., T. Kisaka, and Y. Yamashita.
Fishing effect of a model lift nets, with regard to relation between mesh size and fish length. 2846
Hoar, William S., and Elizabeth Florence Mahon.
The early development of the chum salmon, Oncorhynchus keta (Walbaum). 2854
Hoar, William S., and G. Beth Robertson.
Temperature resistance of goldfish maintained under controlled photoperiods. 2743
Hoar, W. S., and M. A. Ali.
Retinal responses of pink salmon associated with its downstream migration. 2741
Hobbs, Horton H., and C. W. Hart, Jr.
The freshwater decapod crustaceans of the Apalachicola Drainage System in Florida, southern Alabama, and Georgia. 2534
Hockachka, P. W., A. C. Sinclair, and R. Miller.
Diet, gylcogen reserves and resistance to fatigue in hatchery rainbow trout. 2653
Hoffman, Glenn L.
Studies on the life cycle of Apatemon gracilis pellucidus (Yamag). 2862
Hoffman, R. A.
Toxicity of three phosphorus insecticides to cold water game fish. 2158
Holaday, D. A., E. C. Tsivoglou, A. F. Bartsch, and D. E. Rushing.
Effects of uranium ore refinery wastes on receiving waters. 2429
Holden, A. V., and A. J. Brook.
Fertilization experiments in Scottish freshwater lochs I. Loch Kinardochy. 2151
Hollands, M., J. R. Brett, and D. F. Alderdice.
The effect of temperature on the cruising speed of young sockeye and coho salmon. 2274
Hollister, H. J., and A. J. Dodimead.
Progress report of drift bottle releases in the northeast Pacific Ocean. 2254
Holmes, Robert W., et. al.
Physical, chemical, and biological oceanographic observations obtained on expedition scope in the eastern tropical pacific, November-December 1956. 2189
Holmgren, Uno.
On the pineal organ of the tuna, Thynnus thynnus L. 2806
Honma, Yoshiharu.

On the thyroid gland of some Japanese teleosts. 2566

Hood, D. W., B. Stevenson, and L. M. Jeffrey.
Deep sea disposal of industrial wastes. 2432

Hooper, F. F., and K. G. Fukano
Toxaphene (chlorinated camphene) as a selective fish poison. 2180

Hoshina, T., and T. Chiba.
On the bacteriostatic power of malachite green against the causative bacteria of vibrio-disease of rainbow trout. 2623

Hourston, Alan S.
Population studies on Juvenile herring in Barkley Sound, British Columbia. 2257
Effects of some aspects of environment of the distribution of juvenile herring in Barkley Sound. 2651
The relationship of the juvenile herring stocks in Barkley Sound to the major adult herring populations in British Columbia. 2652

Houser, Alfred, and Michel G. Bross.
Observations on growth and reproduction of the paddlefish. 2666

Houston, Arthur Hillier.
Locomotor performance of chum salmon fry (Oncorhynchus keta) during osmoregulatory adaptation to sea water. 2744

Howard, Gerald V., Milner B. Schaefer, and Yvonne M. M. Bishop.
Some aspects of upwelling in the Gulf of Panama. 2122

Hoy, Joe.
A portable conductivity bridge for field use. 2657

Hubbs, Carl. L., and Karl F. Lagler.
Fishes of the Great Lakes region. 2612

Hubbs, Clark, and George E. Drewry.
Long duration of sperm function in two euryhaline fishes and its lack of significance in hybridization. 2123

Huberty, Martin R.
Water resouces of the West, today and tomorrow. 2232

Hublou, W. F.
A plexiglas constant-flow siphon. 2389

Hughes, G. M., and G. Shelton.
The mechanism of gill ventilation in three freshwater teleosts. 2575

Hughes, W. J., J. Van Overbeek, and R. Blondeau.
Acrolein for the control of water weeds and disease-carrying water snails. 2634

Hulsey, A. H., and James Stevenson.
Reclamation of lake Hamilton, Arkansas. 2672

Hunn, Joseph B.
The chemistry of fish blood, a bibliography. 2764

Hunt, Burton P.
Limnetic distribution of Chaoborus larvae in a deep Florida lake (Diptera). 2482

Hunter, J. G., and E. H. Grainger.
Station list of the 1955-58 field investigations of the Arctic unit of the Fisheries Research Board of Canada. "CALANUS" SERIES No.19. 2881

Huntsman, A. G.
Shubenacadie salmon. 2266

Huzita, Tikao.
An experiment on the trial manufacture of lead plate depth-finder for fishing tools. 2614

Hynes, H. B. N.
The biological effects of water pollution. 2446

Ichimura, S., and Y. Aruga.
Some characteristics of photosynthesis of fresh water phytoplankton. 2483

Idler, D. R., and H. Tsuyuki.
Biochemical studies on sockeye salmon during spawning migration. I. Physical measurements, plasma cholesterol, and electrolyte levels. 2464

Idler, D. R., and I. Bitners.
Biochemical studies on sockeye salmon during spawning migration. V. Cholesterol, fat, protein and water in the body of the standard fish. 2373

Ignat'eva, G. M.
On conditions of harmonious hatching in incubation of sturgeon roe. (Ob Usloviiakh Druzhnogo Vykleva Pri Inkubatsii Ikry Osetrovykh). 2712

Inaba, D., M. Nomura, and K. Tominaga.
Studies on the improvement of artificial propagation in trout culture. --I. On the interference of the broken eggs and effect of the egg washing method. 2823

Inaba, D., M. Nomura, and M. Suyama.
Studies on the improvement of artificial propagation in trout culture. --II. On the pH value of eggs, milt, coelomic fluid and others. 2824

Inglis, Anthony., and Donald M. Allen.
A pushnet for quantitative sampling of shrimp in shallow estuaries. 2284

Ingram, W. M., Ludzack, F. J., and M. B. Ettinger.
Characteristics of a stream composed of oil refinery activated sludge effluents. 2553

Ingram, W. M., M. B. Ettinger, P. W. Kabler, M. Katz, F. W. Kittrell, R. Porges, C. M. Tarzwell, W. W. Towne, E. C. Tsivoglou, and R. L. Woodward.
A critical review of the literature of 1957 on water pollution. 2400

Inque, M.
Studies on movements of albacore fishing grounds in the northwest Pacific Ocean. --I. Adaptability of water temperatures for albacores in the winter season from observations of records on catches and optimum water temperatures of fishing boats. 2825

Instituto de Investigaciones Pesqueras. (Inst. of Fisheries Res.)
Third symposium on "Marine Productivity and Development of Fisheries" in the Laboratory of Castellon, Sept. 10-14, 1957. (Te'rcera Reuni'on Sobre "Productividad del Mar y Explotacion Pesquera" en el Laboratorio de Castellon, del 10 at 14 de Septiembre de 1957). 2208

Irie, Takaaki.
On the forming season of annual rings (Opaque

and translucent zones) in the otoliths of several marine teleosts. 2562
Irwin, W. H.
Terramycin as a control for fin rot in fishes. 2676
Isaac, P. C. G., and M. Lodge.
Control of algae in a reservoir. 2161
Ishiyama, Reizo, and Okada Keisuke.
Postlarval form of the skipjack (Katsuwonus pelamis) from the Phoenix Islands. 2603
Itazawa, Yasuo.
Gas content of the blood in reponse to that of medium water in fish. 2455
Influence of temperature on the number of vertebrae in fish. 2541
Comparison of four different methods for the determination of the dissolved oxygen in the fish culture pond water. 2792
Itazawa, Yasuo, K. Iyatomi, T. Tamura, I. Hanyu, and S. Sugiura.
Toxicity of Endrin to fish. 2173
Iversen, Edwin S., and Raymond B. Manning.
A new microsporidan parasite from the pink shrimp (Penaeus duorarum). 2869
Iyatomi, K., T. Tamura, Y. Itazawa, I. Hanyu, and S. Sugiura.
Toxicity of Endrin to fish. 2173

Jackman, M. I., and V. S. Griffiths.
Automatic potentiometric, titration in determination of dissolved oxygen. 2688
Jackson, P. B. N
A revision of the Clariid catfishes of Nyasaland, with a description of a new genus and seven new species. 2334
Jain, S. L.
Monogenea of Indian freshwater fishes. VIII. Sprostonia, a new genus of freshwater Tetraonchinae, with the descriptions of four new species, from the gill filaments of fishes, from Lucknow. 2320
Jannasch, Holger W., and Galen E. Jones.
Bacterial populations in sea water as determined by different methods of enumeration. 2536
Jarnefelt, H.
Limnological survey of some Finnish lakes. XVI. (Sur limnologie einiger gewasser finnlands. XVI). 2549
Limnological survey of some Finnish lakes. XVII. (Sur Limnologie Einiger Gewasser Finnlands. XVII). 2550
Jeffrey, L. M., D. W. Hood, and B. Stevenson.
Deep sea disposal of industrial wastes. 2432
Jennings, F. D., T. R. Folsom, and R. A. Schwartzlose.
Effect of pressure upon the "protected oceanographic reversing thermometer. 2533
Jensen, Albert C.
Corrosion resistance of fish tagging pins. 2191
Jerlov, N. G.
Maxima in the vertical distribution of particles in the sea. 2346
Jerlov, N. G., and Jacques Piccard.
Bathyscaph measurements of daylight penetration into the Mediterranean. 2355
Jermolajev, E. G.
Zooplankton of the inner Bay of Fundy. 2267
Jitts, H. R., and H. Rotschi.
Measure by the C^{14} method of the photo-synthetic activity of some water masses in the south west Pacific in relation to its fertility. 2840
Johnson, H. E., and J. M. Shelton.
Marking chinook salmon fry. 2178
Johnson, James H.
Surface-current studies of Saginaw Bay and Lake Huron, 1956. 2194
Johnson, James H., Alfred Beeton, and Stanford H. Smith.
Lake Superior limnological data, 1951-57. 2771
Johnson, Leon D.
Pond culture of muskellunge in Wisconsin. 2624
Johnson, W. E.
Density and distribution of young sockeye salmon (Oncorhynchus nerka) throughout a multi-basin lake system. 2258
Jones, F. R. Harden, and G. Pearce.
Acoustic reflection experiments with perch (Perca fluviatilis Linn.) to determine the proportion of the echo returned by the swimbladder. 2240
Jones, Galen E., and Holger W. Jannasch.
Bacterial populations in sea water as determined by different methods of enumeration. 2536
Jones, J. D.
A new tonometric method for the determination of dissolved oxygen and carbon dioxide in small samples. 2340
Jones, J. W.
Salmon studies, 1951. 2625
Jones, R. A.
Modifications on an alternate-polarity electrode. 2386
Jones, S.
Authorship of names of Indian fishes proposed in "Histoire Naturelle Des Poissons" by Cuvier and Valenciennes and recorded by Day. 2131
Notes on eggs, larvae and juveniles of fishes from Indian waters. I. Xiphias gladius Linnaeus. 2352
Notes on eggs, larvae and juveniles of fishes from Indian waters. II. Istiophorus gladius (Broussonet). 2896
Juliano Rogelio O., and Donald E. Wohlschlag.
Seasonal changes in bluegill metabolism. 2539
Jullien, A., and J. Ripplinger.
Physiology of the fish heart and its extrinsic innervation (Physiologie du Coeur Des Poissons et de Son Innervation). 2520

Kabler, P.
Use and value of bacterial indicators of pollution. 2910
Kabler, P. W., M. B. Ettinger, W. M. Ingram, M. Katz, F. W. Kittrell, P. Porges, C. M. Tarzwell, W. W. Towne, E. C. Tsivoglou, and R. L. Woodward.
A critical review of the literature of 1957 on water pollution. 2400

Kadak, A. Yu, and L. A. Rannak.
Development of an active fishing industry in the open water of the northeastern Baltic Sea (O Razvitii Aktivnogo Rybolovstva V Otkrytykh Vodakh Severovostochnoy Chasti Baltiyskogo Morya). 2416

Kaj, J.
Spawning of fish in the lower stretch of the Welna River. (Przebieg Tarla Rye W. Dolnym Odcinmku Rzeki Welny). 2798

Kalinkin, S. A.
The technique in catching Baltic salmon. 2699

Kalleberg, Harry.
Observations in a stream tank of territoriality and competition in juvenile salmon and trout (Salmo salar L. and S. trutta L.) 2290

Kanayama, Yukitaka, Hideomi Akora Tuge II, and Hidemasa Ochiai.
Studies of the conditioned reflex in the lower vertebrates. I. Goldfish and sea bream (Pagrosomus major). 2467

Kanda, K., and A. Loike.
A study on the color of fishing nets. I. Observations on the passage of fishes through a colored net. 2810
The study on the color fishing nets. IV. A change in illumination affecting the behavior of a fish school near a colored net. 2813

Kanda, K., A. Loike, and M. Ogura.
A study on the color of fishing nets. II. Behaviors of fish schools in the neighborhood of a colored net. 2811
A study on the color of fishing nets. III. Effect of the depth of color of a net on the behavior of a fish school near the net. 2812

Kanwisher, John
Polarographic oxygen electrode. 2540

Kanwisher, J. W., and D. E. Carritt.
An electrode system for measuring dissolved oxygen. 2687

Kanwisher, J. W., Per Fredrik Scholander, L. van Dam, Harold Theodore Hammel, and Malcolm Stephen Gordon.
Supercooling and osmoregulation in arctic fish. 2832

Kaploysky, A. J.
Estuarine pollution investigation employing same-slack technique. 2484

Karchmer, J. H.
Polarographic determination of dissolved oxygen. Study of drop time with rapid-dropping mercury electrode. 2928

Karchmer, J. H., and C. P. Tyler.
Portable analyser for determination of dissolved oxygen in water. Application of rapid-dropping mercury electrode. 2927

Karohji, Kohei.
Report from the "Oshoro Maru" on oceanographic and biological investigations in the Bering Sea and northern North Pacific in the summer of 1955. IV. Diatom associations as observed by underway samplings. 2317

Kasahara, S., and N. Nakamura.
A study of the phenomenon of the "Tobikoi" or shoot carp--III. On the result of culturing the modal group and the organisms found in sea and ocean depths. 2629

Katayama, Tosiko, and Hiroko Tsukuda.
Temperature adaptation in fishes. I. The influence of rearing temperature on temperature tolerance, growth rate, and body form. 2815

Katz, Max, Austin Pritchard, and Charles E. Warren.
Ability of some salmonids and a centrarchid to swim in water of reduced oxygen content. 2861

Katz, M., M. B. Ettinger, W. M. Ingram, P. W. Kabler, F. W. Kittrell, R. Porges, C. M. Tarzwell, W. W. Towne, E. C. Tsivoglou, and R. L. Woodward.
A critical review of the literature of 1957 on water pollution. 2400

Kawanabe, H.
Social behavior and production of a salmon-like fish, Plecoglossus altivelis, or Ayu with reference to its population density. 2818

Kawanabe, H., N. Mizuno, and N. Nishimura.
Population density of a salmon-like fish, Plecoglossus altivelis, or Ayu, in different river-beds. 2817

Kawakami, Tasae, K. Mitsuhashi, and O. Suzuki.
General theory of fishermen's current measuring device, Siomiito. 2834

Keays, J. W., H. L. Haynes, H. H. Moorefield, and A. J. Borash.
The toxicity of Sevin to goldfish. 2492

Keenleyside, Miles H. A.
Effects of spruce budworm control on salmon and other fishes in New Brunswick. 2391

Keisuke, Okada, and Reizo Ishiyama.
Postlarval form of the skipjack (Katsuwonus pelamis) from the Phoenix Islands. 2603

Kelly, John W., E. Lovell Becker, Robert Bird, John Schilling, Sidney Solomon, and Nelson Young.
Physiology of marine teleosts. I. Ionic composition of tissue. 2357
Physiology of marine teleosts. II. Hematologic observations. 2358

Ketchum, B.
The effects of atomic radiation on oceanography and fisheries. Chapter Subject: Ecological systems and transport in the sea. 2478

Ketchum, B., and W. Wooster.
The effects of atomic radiation on oceanography and fisheries. Chapter Subject: Transport and dispersal in the sea. 2478

Khanna, Dharam Vir.
Observations on the spawning of the major carps at a fish-farm in the Punjab. 2343

Kidama, Y.
Studies on the specific growth of freshwater fishes referring to the weight increase of individual and population--1. Variation of the specific growth and the relation between the average and the individual specific growth by a small population of the brown trout (Salmo trutta L.) reared in a pond. 2848

Kilby, John D., Edward Crittenden, and Lovett E. Williams.

Several fishes new to Florida freshwaters. 2299

Kipling, C., J. W. G. Lund, and E. D. Le Cren.
The inverted microscope method of estimating algal numbers and the statistical basis of estimations by counting. 2456

Kisaka, T.
Experiments to see the effect of color and its depth on the driving net by the centralizing method. 2814

Kitai, H. (Ma'agan Michael).
Mobile pump for increasing the oxygen content of the pondwater. 2141

Kittrell, F. W., M. B. Ettinger, W. M. Ingram, P. W. Kabler, M. Katz, R. Porges, C. M. Tarzwell, W. W. Towne, E. C. Tsivoglou, and R. L. Woodward.
A critical review of the literature of 1957 on water pollution. 2400

Klawe, Witold L., and Bell M. Shimada.
Young scombroid fishes from the Gulf of Mexico 2638

Kleerekoper, H., and Pegronella A. Roggenkamp.
An experimental study on the effect of the swimbladder on hearing sensitivity in Ameiurus nebulosus nebulosus (LeSueur). 2332

Klotter, H. E.
Foaming caused by detergents in a canalized river, its origin and importance. 2430

Knowles, G., R. Briggs, and G. V. Dyke.
Electrical recorder for dissolved oxygen. 2901

Kobayashi, Kiyu.
Larvae and young of the Atka mackerel, Pleurogrammus monopterygius (Pallas), in the north Pacific. 2577

Kobayashi, Shinjiro, and Hachiro Hirata.
Diurnal rhythm of the feeding activity of goldfish in autumn and early winter. 2519

Kobayasi, Hiromu, and Isamu Yamabayashi.
On the acceleration of spawning in a loach, Misgurnus anguillicaudatus (Cantor), by injection of the hypophyses on the same species. 2567

Kobayasi, Hisao, and Toru Hayasi.
Preliminary studies on scale arrangement of Japanese fishes. 2312

Kodama, Y.
Studies on the specific growth of freshwater fishes referring to the weight increase of individual and population--I. Variation of the specific growth and the relation between the average and the individual specific growth by a small population of the brown trout (Salmo trutta L.) reared in a pond. 2847

Koike, A., and K. Kanda.
The study on the color of fishing nets. IV. A change in illumination affecting the behavior of a fish school near a colored net. 2813

Kondo, K., Y. Hiyama, and T. Kisaka.
Differences on the frequency of fishes among several kinds of colours for under-water fencing net. 2621
Difference on the frequency of transfer of fishes with different degrees of inclinations of under-water fencing net. 2622

Korkova, M., and R. Cervenka.
Synchronized determination of pH, alkalinity, calcium and magnesium. 2424

Kosaka, M.
Experimental studies on the habitat preference and evaluation of environment by flatfishes, Limanda yokohamae (Gunther) and Kareius bicoloratus (Basilewsky). 2489

Koto, Hideto, and Takeji. Fujii.
Structure of the waters in the Bering Sea and the Aleutain region. 2144

Kozlyaninov, M. V., and Yu. I. Sorokin.
Determination of the dependence of phytoplankton photosynthesis on the light intensity in the water of the sea of Japan and the Pacific Ocean. 2402

Kramer, Robert H., and Lloyd L. Smith, Jr., and Donald R. Franklin.
Development of quantitative sampling methods for young of the year fish. 2203
Electro-fishing for small fish in lakes. 2872

Kriss, A. E.
Microbiology and the chief problems in the black Sea. 2347

Kriss, A. E., and I. N. Mitzkevich.
Krassilnikoviae: A new class of microorganisms found in sea and ocean depths. 2633

Krumholz, L., et al.
The effects of atomic radiation on oceanography and fisheries. Chapter Subject: Uptake by fresh water organisms. 2478

Krumholz, L., and R. Foster.
The effects of atomic radiation on oceanography and fisheries. Chapter Subject: Uptake by by fresh water organisms. 2478

Kubo, Tatsuro.
A note on the age and race of the red salmon in the North Pacific Ocean. 2578

Kubota, Zenziro., Isao Matsui, and Genzi Shirahane.
Studies on the reproduction of the loach, Misgurnus anguillicaudatus (Cantor). II. On the influence of the loach population density upon the productivity of pond. 2587

Kuchar, Karl Wilhelm.
Influence of bacteria on oxygen distribution in small bodies of water. (Untersuchungen uber den Einfluss der Bakterien auf die Sauerstoffschichtung in Kleingewassern). 2551

Kurogane, K., and Y. Hiyama.
Morphometric comparison of the yellowfin tuna taken from the Equatorial Pacific. 2807
Morphometric comparision of the yellowfin tuna from six grounds in the Indian Ocean. 2857

Kuroki, Toshiro.
Fundamental studies on the relations between under-water sound and fish behaviour (III)---About the echoless-wall of aquarium---. 2545
On the relation between water temperature and the response for stimuli. The investigation to decide the "optimum temperature." 2593
Biophysical studies on the auditory character of fish. I. Directional audibility through one

lateral line. 2831

Kusa, Mamoru, and Tsuguyasu Wada.
X-ray diffraction patterns from the egg membrane of the egg of the brook trout. 2323

Kusa, Mamoru.
Explosion of isolated cortical alveoli of the stickleback egg. 2579

Kusaka, Takaya.
Two experiments to see the effect of mesh size of nets on driving a school of fish to a certain point. 2626
Experiments on the effect of color of nets by the centralizing method and the driving to one side method. 2627
Experiments to see the different effects of net on driving, several species of fish. 2628
Experiments to see the effect of color and its depth on the driving net by the centralizing method. 2814

Kusaka, T., Y. Hiyama, and K. Kondo.
Differences on the frequency of fishes among several kinds of colours for under-water fencing net. 2621
Difference on the frequency of transfer of fishes with different degrees of inclinations of under-water fencing net. 2622

Kusaka, T., Y. Hiyama, and Y. Yamashita.
Fishing effect of a model lift nets, with regard to relation between mesh size and fish length. 2846

Kuthalingam, M. D. K.
Life history and feeding habits of Cynoglossus lingua (Ham. Buch). 2134

Kutkuhn, Joseph H.
The plankton of North Twin Lake, with particular reference to the summer of 1955. 2219
Utilization of gizzard shad by game fishes in North Twin Lake, Iowa. 2573

Labuz, W., L. Musiał, L. Turoboyski, and M. Chobot.
Investigations on contamination of the Sola River and its self purification capabilities. (Badania nad Zanieczyszczeniem Rzeki Soły i jej Zdolnoscia Samooczyszczania). 2618

Lagler, Karl F., and Carl L. Hubbs.
Fishes of the Great Lakes Region. 2612

Lagunov, I. I., and V. V. Azbelev.
On the condition of the Tuloma salmon stock in connection with the work in the fishery on the Tuloma River. (O Sostoianii Tulomskogo Stada Semgi V Sviazi S Rabotoi Rybokhoda Na Reke Tolume). 2706

Lahav, M., and S. Sarig.
The treatment with Lindane of carps and fish-ponds infected with the fish-louse Argulus. 2298

Laird, Marshall.
A secondary effect of DDT upon the aquatic microflora and microfauna. 2552

Lambou, Victor W.
Fish populations of backwater lakes in Louisiana. 2660
Block-off net for taking fish population samples. 2759

Lander, Robert H.
The problem of fishway capacity. 2694

Lander, Robert H., Galen H. Maxfield, and Kenneth L. Liscom.
Leading adult squawfish (Ptychocheilus oregonensis) within an electric field. 2769

Langille, W. M., E. Gordon Young, and D. G. Smith.
The chemical composition of sea water in the vicinity of the Atlantic provinces of Canada. 2364

Larkin, P. A.
The investigation of fish-power problems. 2889

Larkin, P. A., and E. J. Crossman.
Yearling liberations and change of food as affecting rainbow trout yield in Paul Lake, British Columbia. 2664

Larkin, P. A., R. R. Parker, and E. C. Black.
Fatigue and mortality in troll-caught Pacific salmon (Oncorhynchus). 2883

Larsen, Knud, and Sigurd Olsen.
Ochre suffocation of fish in the river Tim Aa. Drainage water from lignite pit as cause of the catastrophes at the Nørre esp trout pond farm 1941-1947. 2378

Lasater, R., I. E. Wallen, and W. C. Green.
Toxicity of Gambusia affinis of certain pure chemicals in turbid waters. 2462

Latta, William C.
Significance of trap-net selectivity in estimating fish population statistics. 2542

Laubet, P., M. L. Bauchot, and R. Bauchot.
Study of the fish fauna of the basin of Arcachon. (Etude de la Faune Ichthyologique du Bassin d' Arcachon (Gironde)). 2231

Lauff, G. H., J. C. Ayers, D. V. Anderson, and D. C. Chandler.
Currents and water masses of Lake Huron. (1954 synoptic surveys). 2683

Laurent, P. J.
Resistance of fresh-water crustaceans to the action of sodium chromate. 2915

Lauzier, L. M., and R. W. Trites.
The deep waters in the Laurentian Channel. 2268

Lawrence, J. M.
Methods for controlling aquatic weeds in fish ponds with emphasis on use of chemicals. 2682

Lazarev, M. S.
Acclimatization of far-eastern salmon in the basin of the Bering Sea. (Raboty Po Akklimatizatsii Dal'nevostochnykh Lososei V Basseine Barentseva Moria). 2714

Lecren, E. D.
Observations on the growth of perch (Perca fluviatilis L.) over twenty-two years with special reference to the effects of temperature and changes in population density. 2139

Lecren, E. D., J. W. G. Lund, and C. Kipling.
The inverted microscope method of estimating algal numbers and the statistical basis of estimations by counting. 2456

Leech, F. B., and M. J. R. Healy.
The analysis of experiments on growth rate. 2314
Lefevre, Marcel.
Concerning the influence of organic matter on the nature and abundance of plankton. (De L' influence Des Matieres Organiques Sur La Nature Et L'a Bondance Du Plancton. 2793
Lefevre, M., and G. Farrugia.
The effect on fresh-water algae of the products of natural decomposition of organic substances of animal and plant origin. 2150
Le Grand, Yves.
The electricity of the oceans. (L'électricité Océanique). 2233
Leim, A. H., and L. R. Day.
Records of uncommon and unusual fishes from eastern Canadian waters, 1950-1958. 2885
Leitritz, Earl.
Mechanical dry-feed dispensers. 2387
Lennon, Robert E.
The electrical resistivity meter in fishery investigations. 2395
Lennon, Robert E., and Phillip S. Parker.
Applications of salt in electro-fishing. 2289
Reclamation of Indian and Abrams Creeks in Great Smoky Mountains National Park. 2767
Lesveaux, John F.
Summary report of survey to evaluate the need for specific fish toxicants in sport fishing waters. 2752
Lewis, Alan G.
The vertical distribution of some inshore copepods in relation to experimentally produced conditions of light and temperature. 2637
Lewis, William M., and Vernon W. Cole.
The removal of residual chlorine from tap water that is to be used in aquaria. 2477
Limbaugh, C.
Marine outfall studies by qualified diving investigators. 2450
Lindenberg, A., and M. Polonovski.
Narcotics and toxicity to fish. 2167
Lindström, Par Thorolf.
Observations sur les cycles annuels des planctons crustacés, dualisme des populations copépodes--répercussion des années froides--differences entre des lacs. 2292
Liscom, Kenneth L., Galen Maxfield, and Robert H. Lander.
Leading adult squawfish (Ptychocheilus oregonensis) within an electric field. 2769
Lissmann, H. W., and K. E. Machin.
The mechanism of object location in Gymnarchus niloticus and similar fish. 2241
Lodge, M., and P. C. G. Isaac.
Control of algae in a reservoir. 2161
Loike, A., and K. Kanda.
A study on the color of fishing nets. I. Observations on the passage of fishes through a colored net. 2810
The study on the color of fishing nets. IV. A change in illumination affecting the behavior of a fish school near a colored net. 2813
Loike, A., K. Kanda, and M. Ogura.
A study on the color of fishing nets. II. Behaviors of fish schools in the neighborhood of a colored net. 2811
A study on the color of fishing nets. III. Effect of the depth of color of a net on the behavior of a fish school near the net. 2812
Long, Clifford W.
Passage of salmonoids through a darkened fishway. 2692
Longhurst, Alan R.
Racial differences in size and growth in the New Zealand snapper. 2639
Lopukhina, A. M., and M. A. Malevitskaya.
Data for the study of parasites of fish in the lower Dnepr (Materialy k izucheniyu parazitov ryb nizhnego Dnepra). 2418
Loukashkin, Anatole S., and Norman Grant.
Behavior and reactions of the Pacific sardine, Sardinops caerulea (Girard) under the influence of white and colored lights and darkness. 2658
Lowe, Rosemary H. (McConnell).
Breeding behaviour patterns and ecological differences between Tilapia species and their significance for evolution within the genus Tilapia (Pisces: Cichlidae). 2336
Ludzack, F. J., W. M. Ingram, and M. B. Ettinger.
Characteristics of a stream composed of oil refinery activated sludge effluents. 2553
Lueck, B. F.
Determination of stream purification capacity. 2554
Lund, J. W. G.
A simple counting chamber for nannoplankton. 2327
Lund, J. W. G., C. Kipling, and E. D. LeCren.
The inverted microscope method of estimating algal numbers and the statistical basis of estimations by counting. 2456
Lynch, R. G.
Municipal, industrial and irrigational use of available water supplies. 2423

MacAulay, M. A., and F. R. Hayes.
Lake water and sediment V. Oxygen consumed in water over sediment cores. 2780
Machin, K. E., and H. W. Lissmann.
The mechanism of object location in Gymnarchus niloticus and similar fish. 2241
Mackenthun, K. M.
The chemical control of aquatic nuisances. A report on the use of chemicals on lakes, ponds and streams for the control of algae, weeds and other aquatic nuisances. 2908
Mac Kenzie, W. C.
Some economic aspects of control by quota. 2287
Mackereth, F. J. H.
A portable core sampler for lake deposits. 2281
Macklin, Robert.
An improved 150-gallon fish-planting tank. 2674
Maeda, Hiroshi.
Studies on Yosa-Naikai 4. Classification of phytoplankton communities and relation between communities and water masses. 2555

Maeda, Tatsuaki.
Study on the salmon fishing grounds in the North Pacific Ocean. 2316
Mago Leccia, Francisco.
The comparative osteology of the scombroid fishes of the genus Scomberomorus from Florida. 2359
Mahon, Elizabeth Florence, and William S. Hoar.
The early development of the chum salmon, Oncorhynchus keta (Walbaum). 2854
Malcolm, W. B.
The populations of Australian "salmon", Arripis trutta (Bloch and Schneider), in Australian waters. 2775
Malevitskaya, M. A., and A. M. Lopukhina.
Data for the study of parasites of fish in the lower Dnepr (Materialy K Izucheniyu Parazitov Ryb Nizhnego Dnepra). 2418
Malyukina, G. A.
Results of the study of the physiology of the analyzors of the lateral line of fish by conditioned reflex methods. (Rezul'taty Izucheniya Fiziologii Analizatora Bokovoi Linii Ryb Metodom Uslovnykh Refleksov). 2242
Mann, H.
The effect of various disinfectants on fish and animals serving as fish food. 2917
Mann, H. T., and D. W. M. Herbert.
The tolerance of some fresh-water fish for sea water. 2159
Manning, Raymond B., and Edwin S. Iversen.
A new microsporidan parasite from the pink shrimp (Penaeus duorarum). 2869
Mansfield, W. W.
The influence of monolayers on evaporation from water storages. III. The action of wind, wave, and dust upon monolayers. 2543
The influence of monolayers on evaporation from water storages. II. Evaporation and seepage from water storages. 2544
Marckmann, K.
The influence of the temperature on the respiratory metabolism during the development of the sea-trout. 2855
Margolis, L.
The occurrence of juvenile Corynosoma (Acanthocephala) in Pacific salmon (Oncorhynchus spp.) 2259
Martinson, E. F., N. V. Galina, and V. IA. Redikson.
On the biotechnique in artificial breeding of pike. (O Biotekhnike Iskusstvennogo Razvedeniia Shchuki). 2705
Matsidaira, Chikayoshi, and Tsutomu Tsuda.
Studies on the analytical method of ammonia and organic nitrogen in sea water. 2216
Matsue, Y., T. Endo, and K. Tabata.
Effect of an insecticide, parathion, on aquatic animals at lower ranges than its lethal concentration. 2820
Matsui, Isao.
The number of eggs discharged at its primary spawning in relation to the number of ovarian eggs in carp. 2602
Matsui, Isao, Zenziro Kubota, and Genzi Shirahane.
Studies on the reproduction of the loach, Misgurnus anguillicaudatus (Cantor). II. On the influence of the loach population density upon the productivity of pond. 2586
Matsuura, Fumio, and Kanehisa Hashimoto.
Comparative studies on two hemoglobins of salmon. 2306
Multiple hemoglobins in fish. 2307
Matyukova, T. G.
Preliminary study of aquatic and shore vegetation in the Tyup Gulf of Lake Issyk-Kul' (Predvaritel'nyye itogi izucheniya vodno-pribrezhnoy rastitel'nosti Tyupskogo zaliva ozera Issyk-Kul'). 2421
Mavrinskaya, L. F.
Motor nerve endings of the skeletal muscles of the lower vertebrates. (Dvigatel'nye Okonchaniya Skeletnykh Myshts Nizshikh Pozvonochnykh). 2213
Maxfield, Galen H., Kenneth L. Liscom, and Robert H. Lander.
Leading adult squawfish (Ptychocheilus oregonensis) within an electric field. 2769
Mayhew, James.
The bluegill, Lepomis macrochirus (Rafinesque) in West Okoboji Lake, Iowa. 2599
Mazuranich, J. J., and W. E. Nielson.
Dry diets for chinook salmon. 2675
McCombie, A. M.
Some relations between air temperatures and the surface water temperatures of lakes. 2778
McConnell, William J., and William F. Sigler.
Chlorophyll and productivity in a mountain river. 2784
McCrimmon, H. R.
Observations on the spawning of lake trout, Salvelinus namaycush, and the post-spawning movement of adult trout in Lake Simcoe. 2195
McHugh, J. L.
Can we manage our Atlantic coastal fishery resources? 2864
McHugh, J. L., R. T. Oglesby, and A. L. Pacheco.
Length, weight, and age composition of the menhaden catch in Virginia waters. 2537
McKenney, Thomas W., Elizabeth C. Alexander, and Gilbert L. Voss.
Early development and larval distribution of the Carangid fish, Caranx crysos (Mitchill). 2201
McKenzie, R. A.
Age and growth of smelt, Osmerus mordax (Mitchill), of the Miramichi River, New Brunswick. 2269
McKenzie, R. A., and B. E. Skud.
Herring migrations in the Passamaquoddy Region. 2270
McMynn, Robert G., and George E. Stringer.
Experiments with toxaphene as fish poison. 2200
Meader, R. W., and F. M. Swain.
Bottom sediments of southern part of Pyramid Lake, Nevada. 2488
Menzel, David Washington.
Utilization of food by the reef fishes Holacanthus

bermudensis and Epinephelus guttatus. 2248
Merkens, J. C.
Studies on the toxicity of chlorine and chloramines to the rainbow trout. 2909
Merrell, David J., and James C. Underhill.
Intro-specific variation in the bigmouth shiner (Notropis dorsalis). 2345
Metcalf, Artie L.
Fishes of Chautauqua, Cowley and Elk counties, Kansas. 2644
Miller, Jack D., B. Theodore Cole, and Hardy J. Bennett.
Tolerance of euryhaline fish forms to dilutions of oil field bleed water. 2504
Miller, R., A. C. Sinclair, and P. W. Hockachka.
Diet, glycogen reserves and resistance to fatique in hatchery rainbow trout. 2653
Miller, Rudolph J.
A review of the seabasses of the genus Centropristes (Serranidae). 2762
Milne, D. J., and A. Prakash.
Food as a factor affecting the growth of Coho salmon off the east and west coast of Vancouver Island, B. C. 2422
Minckley, W. L.
Fishes of the Big Blue River Basin, Kansas. 2645
Mitani, Fumio.
On the spawning shoals of the yellowtail, Seriola quinqueradiata T. and S., migrating to the Danjo islands in the East China sea. 2308
Studies on the growth and age of the yellowtail, Seriola quinqueradiata T. and S., found in Japan and the adjacent region. I. A fundamental consideration on age estimation by vertebrae. 2309
Studies on the maturity and spawning of the yellowtail, Seriola quinqueradiata T. and S., found in the Japanese waters and their adjacent regions. II. Spawning season and spawning area. 2508
Studies on the maturity and spawning of the yellowtail, Seriola quinqueradiata T. et S., found in the Japanese waters and their adjacent regions. I. Bilateral asymmetry of gonad and maturity grade. 2561
Mitjagina, O. V., and V. D. Terentjeva.
Determination of hardness in water using Trilon B. 2425
Mitsugi, Shinsuke, and Chosei Yoshimuta.
Effect of supersonic wave on behavior of fish. 2583
Mitsuhashi, K., T. Kawakami, and O. Suzuki.
General theory of fishermen's current measureing device, Siomiito. 2834
Mitzkevich, I. N., and A. E. Kriss.
Krassilnikoviae: A new class of microorganisms found in sea and ocean depths. 2633
Miyadi, Denzaburo.
Some information of the basic studies on marine biology in Japan. 2724
Miyake, M., S. Arasaki, and K. Nozawa.
On the pathogenetic water mold. I. 2803
Miyake, Y.
A study on the organic productivity and the solubility product of $CaCO_3$ in the ocean by means of the radiocarbon C_{14}. 2841
Miyaki, M., S. Arasaki, and K. Nozawa.
On the pathogenetic water mold. II. 2804
Miyamoto, Hideaki.
Behaviours of fishes entering trap nets. 2589
Mizuno, N., H. Kawanabe, and N. Nishimura.
Population density of a salmon-like fish, Plecoglossus altivelis, or ayu, in different river-beds. 2817
Monchenko, V. I.
On the synonymics of Attheyella northumbrica (Brady) (Copepoda). (K sinonimike Attheyella Northumbrica (Brady) (Copepoda)). 2410
Monstad, Margit.
Fishery literature 1954. (Fiskerilitteratur 1954). 2787
Moore, E. W.
Thermal "pollution" of streams. 2428
Moore, Harvey L.
Doctoral dissertations on the management and ecology of fisheries, additional listings, 1952-55. 2696
Moore, Milo, E.
State of Washington, Department of Fisheries. 2785
Moore, Milo E., and Albert M. Day.
A review of the Japanese salmon fishery. 2698
Moorefield, H. H. H. L. Haynes, A. J. Borash, and J. W. Keays.
The toxicity of Sevin to goldfish. 2492
Moran, P. A. P.
The theory of some genetical effects of population subdivision. 2529
Morgan, G. D.
A study of six different pond stocking ratios of largemouth bass, Micropterus salmoides (Lacepede), and bluegill, Lepomis macrochirus (Rafinesque); and the relation of the chemical, physical and biological data to pond balance and productivity. 2460
Morrow, James E., Jr.
On the morphology of the pectoral girdle in the genus Makaira. 2225
Races of the striped marlin, Makaira mitsukurii, in the Pacific. 2226
Names of the blue marlin and black marlin. 2360
Motwani, M. P., and A. Davis.
Fishes of the River Sone with observations on the zoogeographical significance. 2126
Mount, Donald I.
Spawning behavior of the bluebreast darter, Etheostoma camurum (Cope). 2748
Mowbray, William H., and Marie Poland Fish.
The production of under-water sound by Opsanus Sp., A new toad-fish from Bimini, Bahamas. 2737
Mullan, James W.
Observations on three reclaimed trout ponds in Massachusetts. 2755
Muller, Karl.
Contributions to the biology of juvenile salmon in the Stora and Lilla Lule Alv. (Zur biologie des junglachses (Salmo salar L.) Im Stora und

Lilla Lule Alv). 2590
Muncy, R. Jess.
Flathead catfish. 2227
Movements of channel catfish in Des Moines River, Boone County, Iowa. 2209
Munoz-Boyanes, Guillermo.
Possible introduction of R. Saxatilis into Spain (Sobre la posible introduccion en espana del Roccus saxatilis W.) 2509
Lake salmon for Spanish mainland waters (Salmon de Lago Para Las Aquas Continentales Espanolas). 2582
Murakawa, Goro, Masayoshi Hatanaka, and Masao Takahashi.
Experimental studies on the feeding habits of amberfish, Seriola quinqueradiata T. et S. 2313
Murray, A. R.
A direct-current electrofishing apparatus using separate excitation. 2198
Musiaŀ, L., L. Turoboyski, M. Chobot, and W. Łabuz.
Investigations on contamination of the Soła River and its self purification capabilities. (Badania Nad Zanieczyszczeniem Rzeki Soły I Jej Zdolnoscia Samooczyszczania). 2618

Nakagome, Jun.
Periodical changes of fishing condition and body length formation, relations between both changes and the between northern and southern fishing areas of bigeye tuna around Midway, Hawaii, Marshall and Fanning Islands. 2310
On the seasonal variation of swimming layers of yellowfin tuna, big-eyed tuna and black marlin in the area of Caroline and Marshall Islands. I. On the seasonal variation of swimming layer. 2826
Relation between seasonal variation and big-eyed tuna and vertical distribution of chlorinity. 2827
On the periodical change of fishing conditions and the body length of a whole year and the distribution and migration of swordfish of the northwestern part of the Pacific Ocean. 2848
Nakamura, N., and S. Kasahara.
A study of the phenomenon of the "Tobikoi" or shoot carp--III. On the result of culturing the modal group and the organisms found in sea and ocean depths. 2629
Nakamura, Takehiko.
River pollution by sulphide mine wastes. 2821
Nardone, O. F. M., John L. Ostdiek, and Roland M. Nardone.
Studies on the Alaskan blackfish Dallia pectoralis. I. Habitat, size and stomach analyses. 2338
Nardone, Roland M., John L. Ostdiek, and O. F. M. Nardone.
Studies on the Alaskan blackfish Dallia pectoralis. I. Habitat, Size and stomach analyses. 2338
Neave, Ferris.
The origin and speciation of Oncorhynchus. 2604
Negus, R. W., and M. W. Greene.
Method of measuring and recording of small concentrations of oxygen dissolved in water. 2926
Neil, J. H.
Problems and control of unnatural fertilization of lake waters. 2433
Nelson, Edward M.
The embryology of the swim bladder in the common sucker Catostomus commersoni (Lacapede). 2337
Nelson, Philip R., and John Greenbank.
Life history of the threespine stickleback Gasterosteus aculeatus Linnaeus in Karluk lake and Bare Lake, Kodiak Island, Alaska. 2693
Newell, G. E.
Pollution and the abundance of animals in estuaries. 2448
Newman, H. William.
Observations on aggressiveness in sockeye salmon smolts. 2300
A laboratory for fish behavior studies. 2397
Nicholls, A. G.
The egg yield from brown and rainbow trout in Tasmania. 2124
The Tasmanian trout fishery. III. The rivers of the North and East. 2143
Nichols, Paul R.
Effect of New Jersey-New York pound-net catches on shad runs of Hudson and Connecticut Rivers. 2185
Nicholson, A. J., and Ford Wilke.
Food of porpoises in waters off Japan. 2479
Nielsen, E. Steemann, and V. Kr. Hansen.
Measurements with the Carbon-14 technique of the respiration rates in natural populations of phytoplankton. 2348
Nielson, Reed S.
Hauling and handling of hatchery trout. 2171
Nielson, W. E., and J. J. Mazuranich.
Dry diets for chinook salmon. 2675
Niemuth, Wallace, Warren Churchill, and Thomas Wirth.
The walleye, its life history, ecology and management. 2377
Nikiforov, N. D.
On salmon reproduction. (O vosproizvodstve Semgi). 2707
Nikolyukin, N. I.
Distant hybridization of fish (Otdalennaya gibridizataiya ryb). 2145
Nilsson, Nils-Arvid.
On the food competition between two species of Coregonus in a North-Swedish lake. 2293
Nishimura, N., H. Kawanabe, and N. Mizuno.
Population density of a salmon-like fish, Plecoglossus altivelis, or Ayu, in different river-beds. 2817
Noble, R. E., and C. H. Ellis.
Calculated minimum contributions of Washington's hatchery releases to the catch of salmon on the Pacific coast and the costs assessable to hatchery operations. 2879
Nomura, M., D. Inaba, and K. Tominaga.
Studies on the improvement of artificial propa-

gation in trout culture. --I. On the interference of the broken eggs and effect of the egg washing method. 2823

Nomura, M., D. Inaba, and M. Suyama.
Studies on the improvement of artificial propagation in trout culture. --I. On the pH value of eggs, milt, coelomic fluid and others. 2825

Nooue, M., and M. Ogura.
The characteristic behaviors of anchovy shoals called "rippling" and "jumping" in Tokyo Bay. 2836

Northrop, John, Maurice Blajk, and Roberto Frassetto.
Bathymetry of the Gibbs Hill area, Bermuda. 2531

Norvell, John, and Frank J. Schwartz.
Food, growth and sexual dimorphism of the redside dace Clinostomus elongatus (Kirtland) in Linesville Creek, Crawford County, Pennsylvania. 2750

Nozawa, K., S. Arasaki, and M. Miyake.
On the pathogenetic water mold. I. 2803
On the pathogenetic water mold. II. 2804

Nozawa, K., and Y. Nozawa.
Studies on the protoplasm of algae III. The correlation between salinity of sea water and toxicity of ammonium sulfate to the laver cell. 2788

Nozawa, Y., and Nozawa K.
Studies on the protoplasm of algae III. The correlation between salinity of sea water and toxicity of ammonium sulfate to the laver cell. 2788

Nümann, W.
Natural and artificial "red water" with consequent death of fish in the sea. 2163

Nusbaum, I.
Dissolved oxygen determination. 2900

Ochiai, Hidemasa, Hideomi Akira Tuge, II, and Yukitaka Kanayama.
Studies of the conditioned reflex in the lower vertebrates. I. Goldfish and sea bream (Pagrosomus major). 2467

Ochiai, Hidemasa, and Hideomi Tuge.
Studies of the conditioned reflex in the lower vertebrates. II. Early development of the defensive conditioned reactions in fish larvae. 2468

O'Connor, D. J.
The measurement and calculation of stream reaeration ratio. 2437

Ogino, C., and M. Suyama.
Variations in amino acid composition of protein during the development of egg and the growth of young fish of rainbow trout, Salmo irideus. 2632

Oglesby R. T., J. L. McHugh, and A. L. Pacheco.
Length, weight, and age composition of the menhaden catch in Virginia waters. 2537

Ogura, M., K. Kanda, and A. Loike.
A study on the color of fishing nets. II. Behaviors of fish schools in the neighborhood of a colored net. 2811
A study on the color of fishing nets. III. Effect of the depth of color of a net on the behavior of a fish school near the net. 2812

Ogura, M., and M. Nooue.
The characteristic behaviors of anchovy shoals called "rippling" and "jumping" in Tokyo Bay. 2836

Oguri, M., and T. Hibiya.
Studies on the adrenal gland of teleosts-II. On the adrenal tissues in 15 species of fishes-II. 2630

Okubo, Katsuwo.
Study on the bio-assay method for the evaluation of water pollution--I. An attempt to use brine shrimp as a test animal. 2606

Olivereau, Madeleine.
Anatomical and histological study of the thyroid gland of the tuna (T. Thynnus and G. alalunga) (Etude Anatomique et Histologique de la Glande Thyroide du Thon (Thunnus thynnus L. et Germo alalunga)). 2491

Olsen, Sigurd, and Knud Larsen.
Ochre suffocation of fish in the River Tim Aa. Drainage water from lignite pit as cause of the catastrophes of the Nørre Esp trout pond farm 1941-1947. 2378

Olson, Paul R., Lauren R. Donaldson, and John R. Donaldson.
The fern lake trace mineral metabolism program. 2659

Onodera, K.
On the survival of trout fingerlings stocked in a mountain brook. --I. The estimation of survival rate by observation. 2849

Ordal, Erling J., and James W. Wood.
Tuberculosis in Pacific salmon and steelhead trout. 2362

Ostdiek, John L., O. F. M., and Roland M. Nardone.
Studies on the Alaskan blackfish Dallia pectoralis. I. Habitat, size and stomach analyses. 2338

Otsu, Tamio, and Richard N. Uchida.
Sexual maturity and spawning of albacore in the Pacific ocean. 2398
Study of age determination by hard parts of albacore from central north Pacific and Hawaiian waters. 2399

Owen, John B.
The erosion-littoral zone of North Twin Lake, and its relation to dredging. 2485

Pacheco, A. L., J. L. McHugh, and R. T. Oglesby.
Length, weight, and age composition of the menhaden catch in Virginia waters. 2537

Paloheimo, J. E.
A method of estimating natural and fishing mortalities. 2276

Paloumpis, Andreas A.
Responses of some minnows to flood and drought conditions in a intermittent stream. 2210
Measurement of some factors affecting the catch in a minnow seine. 2600

Paluch, J.
Daily variations of oxygen content in the waters

of the river basin (Dobowe Zmiany Zawartosci Tlenu W Wodzie Zbiornike Rzecznego). 2486
Parisot, Thomas J., and A. John Ross.
Record of the fungus Ichthyosporidium Caullery and Mesnil, 1905, in Idaho. 2471
Parker, Phillip S., and Robert E. Lennon.
Applications of salt in electro-fishing. 2289
Reclamation of Indian and Abrams Creeks in Great Smoky Mountains National Park. 2767
Parker, Richard A., and Arthur D. Hasler.
Movements of some displaced centrarchids. 2303
Parker, Robert P., and Edgar C. Black.
Muscular fatigue and mortality in troll-caught chinook salmon (Oncorhynchus Tshawytscha). 2367
Parker, R. R., E. C. Black, and P. A. Larkin.
Fatigue and mortality in troll-caught Pacific salmon (Oncorhynchus). 2883
Parsons, John W.
Muskellunge in Tennessee streams. 2871
Patterson, Ashton M.
Turbulence spectrum studies in the sea with hot wires. 2280
Pavlov, P. I.
The Danube bream as compared to the Dnieper bream. (Pridunaisky Leshch V. Sravnenii S. Dneprovskim). 2228
Pearce, G., and F. R. Harden Jones.
Acoustic reflection experiments with perch (Perca fluviatilis Linn.) to determine the proportion of the echo returned by the swim-bladder. 2240
Phillips, Authur M., Jr.
The known and possible role of minerals in trout nutrition and physiology. 2870
The known and possible role of minerals in trout nutrition and physiology. 2871
Phillips, Arthur M., Jr., and D. R. Brockway.
Dietary calories and the production of trout in hatcheries. 2380
Phillips, J. B.
Rockfish review. 2497
Phillips, John.
Aspects of P ^{32} metabolism in lakes. 2322
Piccard, Jacques, and N. G. Jerlov.
Bathyscaph measurements of daylight penetration into the Mediterranean. 2355
Pickering, Q. H., C. Henderson, and C. M. Tarzwell.
Relative toxicity of ten chlorinated hydrocarbon insecticides to four species of fish. 2662
Pickering, Q. H., C. Henderson, and J. M. Cohen.
The toxicity of synthetic detergents and soaps to fish. 2916
Picotti, M.
The development of oceanography and its progress during the last half-century (Lo Sviluppo della Oceanografia E Il Suo Progresso Nell'ultimo Cinquantennio). 2474
Pierce, E. Lowe.
The Chaetognatha of the inshore waters of North Carolina. 2279
Pillay, T. V. R.
Morphological and physiological characters of the blood of Hilsa, Hilsa Ilisha (Hamilton) of the River Hooghly. 2239
Piper, Robert G., and Ken Wolf.
Cost of disease treatment. 2757
Pisarenkova, A. S.
Storage and transportation of sperm of rainbow trout and pike. (Khranenie I Transportirovka spermy Raduzhnoi Foreli I Shchuki). 2713
Platts, W. S.
Homing, movements, and mortality of wild cutthroat trout (Salmo clarki Richardson) spawned artificially. 2385
Plomann, J.
The plant poison "Rotenone" and its importance for fisheries. 2920
Poll, Max.
The genera of freshwater fishes of Africa. (Les genres de Poissons D'eau Douce de L'Afrique). 2229
Polonovski, M., and A. Lindenberg.
Narcotics and toxicity to fish. 2167
Ponomareva, L. A.
Spawning population of euphausiidae at the Southwest Sakhalin coast. (Nerestovye Skopleniia Eufauziid U Iugo-Zapadnogo Poberezh'ia Sakhalina). 2708
Popov, K. I.
On measures of increasing the stock of far-eastern salmon. (O Merakh Po Uvelicheniiu Zapasov Dal' Nevostochnykh Lososei). 2709
Porges, R., M. B. Ettinger, W. M. Ingram, P. W. Kabler, F. W. Kittrell, M. Katz, C. M. Tarzwell, W. W. Towne, E. C. Tsivoglou, and R. L. Woodward.
A critical review of the literature of 1957 on water pollution. 2400
Post, George.
A preliminary report on the use of nitrofuran compounds for furunculosis of trout, with special emphasis on furoxone. 2384
Power, G.
The evolution of the freshwater races of the Atlantic salmon (Salmo salar L.) in eastern North America. 2570
Prakash, A., and D. J. Milne.
Food as a factor affecting the growth of Coho salmon off the east and west coast of Vancouver Island, B. C. 2422
Prasad, R. R.
A note on the occurrence and feeding habits of Noctiluca and their effects on the plankton community and fisheries. 2559
Pratt, David M., and Harold Berkson.
Two sources of error in the oxygen light and dark bottle method. 2783
Pravdin, I. F.
Fish preserves, fish and fish supply in western Karelian Lakes (Rybnyye Ugod'ys Ryby I Rybnyye Zapasy Vodoyemov Zapadnoy Karelii). 2413
Prometz, Ernest D., William F. Royce, and Raymond J. Buller.
Decline of the yellowtail flounder (Limanda ferruginea). 2697

Prescott, David M.
Effect of activation on the water permeability of salmon eggs. 2586
Pritchard, Austin, Max Katz, and Charles E. Warren.
Ability of some salmonids and a centrarchid to swim in water of reduced oxygen content. 2861
Proshkina-Lavrenko, A. I.
New Chaetoceros genera from the Black and Azov seas (Novyye Predstaviteli Roda Chaetoceros iz Chernogo i Azovskogo Morey). 2414
Protasov, A. A.
The role of dwarf males in the artificial propagation of Kura River salmon. (Rol. Karlikovykh Samtsov Pri Promyshlennom Razvedenii Kurinskogo Lososya). 2237
Prowse, G. A., and J. F. Talling.
The seasonal growth and succession of plankton algae in the White Nile. 2283
Puchkov, V. G.
Larvae of the subfamily Heterogastrinae (Heteroptera, Lugaeidae) of the Ukrainian fauna (Lichinki podsemeystva heterogastrinae (Heteroptera lugaeidae) fauny Ukrainskoy SSR). 2411

Radhakrishnan, N.
A contribution to the biology of Indian sand whiting--Sillago sihama (Forskål). 2510
Raghu, Prasad R.
Reproduction in Clevelandia ios (Jordan and Gilbert) with an account of the embryonic and larval development. 2527
Ramaswami, L. S., and B. I. Sundararaj.
Induced spawning in the catfish Heteropneustes with mammalian chorionic gonadotrophins. 2490
Action of Enzymes on the gonadotrophic activity of pituitary extracts of the Indian catfish Heteropneustes. 2801
Rand, M. C.
Concepts of surface reaeration A critical review. 2556
Rannak, L. A., and A. Yu. Kadak.
Development of an active fishing industry in the open water of the northeastern Baltic Sea (O Razvitii Aktivnogo Rybolovstva V Otkrytykh Vodakh Severovostochnoy Chasti Baltiyskogo Morya). 2416
Rao, K. Srinivasa, and P. N. Ganapati.
On the bionomics of Sardinella gibbosa (BLKR) off Waltair Coast. 2132
Rasquin, Priscilla.
Observations on the metamorphosis of the bonefish, Albula vulpes (Linnaeus). 2611
Raymond, Howard L., and Carl H. Elling.
Fishway capacity experiment, 1956. 2768
Redfield, A. C.
The biological control of chemical factors in the environment. 2548
Redikson, V. IA., N. V. Galina, and E. F. Martinson.
On the biotechnique in artificial breeding of pike. 2705
Rees, Gwendolen, D. Sc.
Ditrachybothridium macrocephalum Gen. Nov., Sp. Nov., a cestode from some elasmobranch fishes. 2318
Rees, William H.
Effects of stream dredging on young silver salmon (Oncorhynchus kisutch) and bottom fauna. 2876
Reich, K., and M. Rotberg.
Some factors influencing the formation of Toxin poisonous to fish in bacteria-free cultures of Prymnesium. 2680
Reid, Joseph L., Jr.
A comparison of drogue and GEK measurements in deep water. 2278
Reineke, Ezra Paul, and Paul Oliver Fromm.
Some aspects of thyroid physiology in rainbow trout. 2830
Reish, Donald.
A discussion of the importance of the screen size in washing quantitative marine bottom samples. 2522
Renn, C.
The effects of atomic radiation on oceanography and fisheries. Chapter Subject: Properties of atomic wastes. 2478
Resch, G., and R. Freier.
Determination of dissolved oxygen in water. 2925
Revelle, R., and M. Shaefer.
The effects of atomic radiation on oceanography and fisheries. Chapter Subject: General considerations. 2478
Rice, T. R., and Virginia M. Willis.
Uptake, accumlation and loss of radioactive Cerium-144 by marine planktonic algae. 2779
Richardson, William S., and Charles H. Wilkins.
An airborne radiation thermometer. 2502
Ricker, W. E.
Maximum sustained yields from fluctuating environments and mixed stocks. 2260
Some principles involved in regulation of fisheries by quota. 2285
Riegel, J. A.
The systematics and distribution of crayfishes in California. 2361
Riggs, Carl D., and Kermit E. Sneed.
The effects of controlled spawning and genetic selection on the fish culture of the future. 2667
Ripplinger, J., and A. Jullien.
Physiology of the fish heart and its extrinsic innervation (Physiologie Du Coeur Des Poissons et de Son Innervation). 2520
Robertson, G. Beth, and William S. Hoar.
Temperature resistance of goldfish maintained under controlled photoperiods. 2743
Robertson, O. H., and S. Hane.
Changes in plasma 17-hydroxycorticosteroids accompanying sexual maturation and spawning of the Pacific salmon (Oncorhynchus tschawytscha). 2751
Robins, C. Richard.
Some aspects of the behavior of the blennoid fish Chaenopsis ocellata Poey. 2736

Rockwell, Julius, Jr., and Sung Pal Chur.
An underwater observation chamber. 2756
Roggenkamp, Pegronella A., and H. Kleerekoper.
An experimental study of the effect of the swim-bladder on hearing sensitivity in Ameiurus nebulosus nebulosus (LeSueur). 2332
Rose, S. Meryl.
Failure of survival of slowly growing members of a population. 2837
Rosenthal, Harold L.
Comparative uptake of Calcium-45 and Strontium-90 by wild and lordotic guppies. 2222
Ross, A. John, and Thomas J. Parisot.
Record of the fungus Ichthyosporidium Caullery and Mesnil, 1905, in Idaho. 2471
Ross, Robert D.
Some taxonomic problems of Shenandoah River fishes. 2202
Game fish streams and records of fishes from the Potomac-Shenandoah River system of Virginia. 2646
Rossi, L. A.
Notes on methods of estimation of plankton. II. Suggestions for the analysis of plankton in waters of high turbidity. 2149
Rotberg, M., and K. Reich.
Some factors influencing the formation of Toxin poisonous to fish in bacteria-free cultures of Prymnesium. 2680
Rotschi, H., and H. R. Jitts.
Measure by the C^{14} method of the photo-synthetic activity of some water masses in the south west Pacific in relation to its fertility. 2840
Rounsefell, George A., and John E. Evans.
Large-scale experimental test of copper sulfate as a control for the Florida red tide. 2193
Roy, P., R. D. Chakrabarty, and S. B. Singh.
A quantitative study of the plankton and the physico-chemical conditions of the River Jumna at Allahabad in 1954-55. 2895
Royce, William F., Raymond J. Buller, and Ernest D. Premetz.
Decline of the yellowtail flounder (Limanda ferruginea). 2697
Rucker, R. R.
Vibrio infections among marine and fresh-water fish. 2382
Rucker, R. R., Raymond W. Guenther, and S. W. Watson.
Etiology of sockeye salmon "Virus" disease. 2402
Rudakov, N. P.
Comparative absorption of Calcium-45 and Strontium-90 by young salmon. (Sravnitel'noe Pogloshchenie Kal' Tsiia-45 I Stronstsiia-90 Mal'kami Lososia). 2710
Rushing, D. E., E. C. Tsivoglou, A. F. Bartsch, and D. A. Holaday.
Effects of uranium ore refinery wastes on receiving waters. 2429
Ryan, James H.
California inland angling estimates for 1954, 1956, and 1957. 2641

Saha, K. C., and D. P. Sen.
Studies on the mortality in spawn and fry of Indian major carps during transport. Part IV. Types of containers used for transporting spawn and fry under oxygen pressure. 2353
Saha, K. C., D. P. Sen, A. K. Roy Chowdhury, and S. K. Chakravarty.
Studies on the factors influencing spawning of Indian major carps in "Bundh" fisheries. 2511
Saidov, Yu. S.
Fish helminth in certain small lakes of Dagestan (Gel'mintofauna Ryb Nekotorykh Malykh Vodoyemov Dagestana). 2415
Saisyo, Toshio.
Seasonal change of plankton diatoms in Kagoshima Bay. 2557
Saito, Kaname.
Biochemical studies on the fish blood-XIV. On the mean corpuscular constant and shape of red corpuscule. 2546
Salvesen, J. R., and M. Daum.
Turbine aeration as a method of increasing the purification capacity of a stream. 2905
Sara, M.
Problems of speciation in marine animals. (Problemi di Speciazone Negli Animali Marine). 2571
Sarig, S., and M. Lahav.
The treatment with Lindane of carps and fish-ponds infected with the fish-louse Argulus. 2298
Saunders, J. W., and M. W. Smith.
Movements of brook trout, Salvelinus fontinalis (Mitchill), between and within fresh and salt water. 2271
Saurov, M. M.
Radioactive contamination of fish in waters containing strontium. 2454
Schaefer, Milner B.
Biological and economic aspects of the management of commercial marine fisheries. 2863
Schaefer, Milner B., Yvonne M. M. Bishop, and Gerald V. Howard.
Some aspects of upwelling in the gulf of Panama. 2122
Scheier, A., and J. Cairns.
The effects of periodic low oxygen upon the toxicity of various chemicals to aquatic organisms. 2445
Schiemenz, F.
The special importance of aquatic plants for fisheries and stream maintenance in small flowing waters. 2162
Schiffman, R. H., and P. O. Fromm.
Chromium-induced changes in the blood of rainbow trout, Salmo gairdnerii. 2918
Schiffman, R. H., and P. R. Fromm.
Measurement of some physiological parameters in rainbow trout (Salmo gairdnerii). 2333
Schilling, John, E. Lovell Becker, Robert Bird, John W. Kelly, Sidney Solomon, and Nelson

Young.
Physiology of marine teleosts. I. Ionic composition of tissue. 2357
Physiology of marine teleosts. II. Hematologic observations. 2358
Schmidt, J., and P. D. Haney.
Representative sampling and analytical methods in stream studies. 2442
Schmitz, William Robert.
Artificially induced circulation in thermally stratified lakes. 2407
Schmulbach, J.
Angling success on the Des Moines. 2512
Schoeneman, Dale E.
Survival of downstream migrant salmon passing Alder Dam in an open flume. 2874
Schoffman, Robert J.
Age and rate of growth of the bluegills in Reelfoot Lake, Tennessee, for 1950 and 1958. 2325
Scholander, Per Fredrik, and Levie Van Dam.
Micro gasometric determination of oxygen in fish blood. 2850
Scholander, Per Fredrik, Levie Van Dam, John Willis Kanwisher, Harold Theodore Hammel, and Malcolm Stephen Gordon.
Supercooling and osmoregulation in arctic fish. 2832
Schroepfer, G. J.
Application of stream data to waste treatment plant design. 2443
Schwartz, Frank J., and John Norvell.
Food, growth and sexual dimorphism of the redside dace Clinostomus elongatus (Kirtland) in Linesville Creek, Crawford County, Pennsylvania. 2750
Schwartzlose, R. A., T. R. Folsom, and F. D. Jennings.
Effect of pressure upon the "protected" oceanographic reversing thermometer. 2533
Scofield, W. L.
History of kelp harvesting in California. 2891
Scott, R. H., et. al.
Organization of cooperative state-industry stream studies in Wisconsin. 2220
Scott, W. B.
A checklist of the freshwater fishes of Canada and Alaska. 2473
Seabloom, Robert Wendell.
Water quality studies in the Wenatchee River Basin. 2188
Sebestyen, Olga.
Study on organic sediment in the erosion-littoral of Lake Balaton. Patri Tanulmany. 2794
Semenov, K. I.
The effect of different light conditions on the development of sturgeon larvae in the period from hatching to transition to active feeding (artificial breeding). 2182
Sen, D. P., and K. C. Saha.
Studies on the mortality in spawn and fry of Indian major carps during transport. Part IV. Types of containers used for transporting spawn and fry under oxygen pressure. 2353
Sen, D. P., K. C. Saha, A. K. Roy Chowdhury, and S. K. Chakravarty.
Studies on the factors influencing spawning of Indian major carps in "Bundh" fisheries. 2511
Seshadri, B.
Seasonal variations in the total biomass and total organic matter of the plankton in the Marine Zone of the Vellar Estuary. 2133
Seymour, Allyn.
Effects of temperature upon the formation of vertebrae and fin rays in young Chinook salmon. 2668
Shaefer, M.
The effects of atomic radiation on oceanography and fisheries. Chapter Subject: Large scale biological experiments with tracers. 2478
Shaefer, M., and R. Revelle.
The effects of atomic radiation on oceanography and fisheries. Chapter Subject: General considerations. 2478
Shapiro, Joseph.
The core-freezer-a new sampler for lake sediments. 2130
Shapovalov, Leo, William A. Dill, and Almo J. Cordone.
A revised check list of the freshwater and anadromous fishes of California. 2892
Shcherbakova, Z. P., and T. V. Sklyarova.
Origin and development of plankton and benthos on collective farms in Voronezhskaya Oblast (K Voprosu O Sostave I Razvitii Planktona I Bentosa Kolkhozynkh Prudov Voronezhskoy Oblasti). 2417
Shelton, G.
The respiratory centre in the tench (Tinca tinca L.). I. The effects of brain transection on respiration. 2341
Shelton, G., and G. M. Hughes.
The mechanism of gill ventilation in three freshwater teleosts. 2575
Shelton, J. M.
Marking chinook salmon fry. 2178
Shemanskiy, Yu. A.
Fishing with sound (Lov Ryby Na Zvuk). 2146
Shepard, M. P., and F. C. Withler.
Spawning stock size and resultant production for Skeena sockeye. 2261
Sheps, Mindel C.
An examination of some methods of comparing several rates on proportions. 2315
Shimada, Bell M., and Witold L. Klawe.
Young scrombroid fishes from the Gulf of Mexico. 2638
Shirahane, Genzi, Zenziro Kubota, and Isao Matsui.
Studies on the reproduction of the loach, Misgurnus anguillicaudatus (Cantor). II. On the influence of the loach population density upon the productivity of pond. 2587
Shuravel', P. A.
A mysis that is new for the Dnepr system-Hemimysis anomala Sars-in the Dnepr Reservoir (Novaya Dlya Sistemy Dnepra Mizida-Hemimysis Anomala Sars V Dneprovskom Vodokhranilishche). 2409

Sigler, William F.
The ecology and use of carp in Utah. 2147
Sigler, William F., and William J. McConnell.
Chlorophyll and productivity in a mountain river. 2784
Sinclair, A. C., R. Miller, and P. W. Hockachka.
Diet, glycogen reserves and resistance to fatigue in hatchery rainbow trout. 2653
Singh, S. B., R. D. Chakrabarty, and P. Roy.
A quantitative study of the plankton and the physico-chemical conditions of the River Jumna at Allahabad in 1954-55. 2895
Skerman, T. M.
Seasonal variations in sea-water surface temperatures within New Zealand harbours. 2234
Sklyarova, T. V., and Z. P. Shcherbakova.
Origin and development of plankton and benthos on collective farms in Voronezhskaya Oblast (K Voprosu O Sostave I Razvitii Planktona I Bentosa Kolkhoznykh Prudov Voronezhskoy Oblasti). 2417
Skud, B. E., and R. A. McKenzie.
Herring migrations in the Passamaquoddy Region. 2270
Slastenenko, E. P.
The freshwater fishes of Canada. 2858
Smirnova, L. I.
The phytoplankton of the northwest part of the Pacific Ocean. (O Fitoplanktone Severo-Zapadnoi Chasti Tikhogo Okeana). 2235
Smith, D. G., E. Gordon Young, and W. M. Langille.
The chemical composition of sea water in the vicinity of the Atlantic provinces of Canada. 2364
Smith, F. G. Walton.
Mystery of the Red Tide. 2594
Smith, Lloyd L., Jr., Donald R. Franklin, and Robert H. Kramer.
Development of quantitative sampling methods for young of the year fish. 2203
Electro-fishing for small fish in lakes. 2872
Smith, M. W., and J. W. Saunders.
Movements of brook trout Salvelinus fontinalis (Mitchill) between and within fresh and salt water. 2271
Smith, Stanford H., Alfred Beeton, and James H. Johnson.
Lake superior limnological data. 1951-57. 2771
Sneed, K. E., and H. P. Clemens.
Effect of temperature and physiological condition on tolerance of channel catfish to pyridylmercuric acetate (PMA). 2170
The use of human chorionic gonadotrophin to spawn warm-water fishes. 2754
Sneed, Kermit E., and Carl D. Riggs.
The effects of controlled spawning and genetic selection on the fish culture of the future. 2667
Snieszko, S. F., C. E. Dunbar, and G. L. Bullock.
Resistance to ulcer disease and furunculosis in eastern brook trout, Salvelinus fontinalis. 2753
Snow, J. R.
Notes on the propagation of the flathead catfish, Pilodictis olivaris (Rafinesque). 2673
Sogandares, Bernal Franklin.
Digenetic trematodes of marine fishes from the Gulf of Panama and Bimini, British West Indies. 2734
Solomon, Sidney, E. Lovell Becker, Robert Bird, John W. Kelly, John Schilling, and Nelson Young.
Physiology of marine teleosts. I. Ionic composition of tissue. 2357
Physiology of marine teleosts. II. Hematologic observations. 2358
Sommani, Ernesto.
Ecological and ethological characteristics of the rainbow trout (Salmo gairdnerii rich.), in relation to its establishment in mountain streams (Caratteristiche Ecoetologiche Della Trota Iridea (Salmo gairdnerii Rich.) in Relazione Ai Ripopolamenti Dei Corsi D'acqua Montani. 2513
Sorokin, J. I.
The results and prospects of using Carbon-14 for a study of organic matter cycle in water basins. 2845
Sorokin, Yu. I., and M. V. Kozlyaninov.
Determination of the dependence of phytoplankton photosynthesis on the light intensity in the water of the Sea of Japan and the Pacific Ocean. 2402
Spaas, J. T.
Contributions to the comparative physiology and genetics of the European Salmonidae. I. Method for the determination of the oxygen consumption in ova, alevins, and fishes of different sizes. 2153
Sparks, Albert K.
Some digenetic trematodes of fishes of Grand Isle, Louisiana. 2564
Spillmann, J., and J. Arnoult.
On some special techniques which facilitate the maintenance and transportation of living aquatic animals. (Sur Quelques Techniques Actuelles Facilitant Le Confinement Et Leetransport D' Animaux Aquatiques Vivants). 2833
Srinivasachra, H. R.
Development of the skull in catfishes. I. Development of chondrocranium in Silonia, Pangasus and Ailia (Schilberdae). 2470
Sroufe, Stanley Alexander, Jr.
Studies on the morphology and development of Mazocraeoides olentangiensis N. sp., (Trematoda: monogenea), a parasite of the gizzard shad, Dorosoma cepedianum (Le Sueur). 2648
Stagg, Martha W., and Richard J. Goss.
The regeneration of fins and fin rays in Fundulus heteroclitus 2137
Stahl, J. B., and D. G. Frey.
Measurements of primary production on Southampton Island in the Canadian artic. 2282
Stammer, H. A.
Toxicity towards fish shown by various slime-controlling agents used in the paper and pulp industry. 2157
Stangenberg, M.
The chemical composition and the bacteriological

contamination of the Niemen River waters. (Skład Chemiczny I Bakteriologiczne Wskazniki Zanieczyszczenia Wod Rzeki Niemna). 2619
A general outlook on the chemical composition of river waters in Poland. (Ogolny Poglad Na Skład Chemiczny Wod Rzecznyck Polski.) 2620

Starmach, K.
Characteristics of rivers from biological and fishery point of view. (Rybacka I Biologiczna Charakterystyka Rzek). 2514

Stearns, Charles R., and Reid A. Bryson.
A mechanism for the mixing of the waters of Lake Huron and South Bay, Manitoulin Island. 2777

Steele, John, H.
The quantitative ecology of marine phytoplankton. 2526

Steffan, August Wilhelm.
Comparative ecological investigations of growth and feeding of two populations of S. Trutta of the north Swedish wooded region. (Vergleichende -Okologische Untersuchungen Uber Wachstum Und Ernahrung Von Zwei Salmo trutta- populationen Des Nordschwedischen Valdgebietes). 2591

Stenger, Albert H.
A study of the structure and development of certain reproductive tissues of Mugil Cephalus Linnaeus. 2738

Steven, D. M.
Studies on the shoaling behaviour of fish. I. Responses of two species to changes of illumination and to olfactory stimuli. 2717

Stevenson, B., D. W. Hood, and L. M. Jeffrey.
Deep sea disposal of industrial wastes. 2432

Stevenson, J., and A. H. Hulsey.
Reclamation of Lake Hamilton, Arkansas. 2672

Stickney, Alden P.
Ecology of the Sheepscot River Estuary. 2773

Stolk, A.
Pathological parthenogenesis in viviparous toothcarps. 2223

Streeter, H. W.
The oxygen sag and dissolved oxygen relationships in streams. 2436

Stringer, George E., and Robert G. McMynn.
Experiments with Toxaphene as fish poison 2200

Stross, Raymond George.
Experimentally induced changes in lakes. A) Environmental changes following lime application to stained lakes. B) Changes in the planktonic Crustacea following the introduction of trout to a fish-free lake. 2250

Stroud, R. H.
Super-insecticides--space-age pollutants. 2515

Sublette, James E., and Charles D. Hancock, Jr.
A survey of the fishes in the upper Kisatchie drainage of west central Louisiana, 1958. 2565

Sublette, James E., and Mary Smith Sublette.
The physico-chemical features and bottom fauna of Chaplin's Lake, Natchitoches Parish, La. 2487

Sublette, Mary Smith, and James E. Sublette.
The physico-chemical features and bottom fauna of Chaplin's Lake, Natchitoches Parish, La. 2487

Sugiura, S., K. Iyatomi, T. Tamura, Y. Itazawa, and I. Hanyu.
Toxicity of Endrin to fish. 2173

Sukacheva, O. A., and A. M. Beskrovnyy.
A histological analysis of the gonads of lake Chudskoye whitefish acclimatized in Khar'kov Oblast Basins. (Gistologicheskiy Analiz Gonad Chudskogo Siga, Akklimatiziruyemogo V Vodoyemakh Kharkovskoy Oblasti). 2408

Sundararaj, B. I., and L. S. Ramaswami.
Induced spawning in the catfish Heteropneustes with mammalian chorionic gonadotrophins. 2490
Action of enzymes on the gonadotrophic activity of pituitary extracts of the Indian catfish Heteropneustes. 2801

Surber, Eugene W.
Cricotopus bicinctus, a midgefly resistant to electroplating wastes. 2865

Suttkus, Royal D.
Notropis uranoscopus, a new cyprinid fish from the Alabama River system. 2304

Suyama, M.
Changes in the amino acid composition of protein during the development of rainbow trout eggs. 2802

Suyama, M., and C. Ogino.
Variations in amino acid composition of protein during the development of egg and the growth of young fish of rainbow trout (Salmo irideus). 2632

Suyama, M., D. Inaba, and M. Nomura.
Studies on the improvement of artificial propagation in trout culture.--I. On the pH value of eggs, milt, coelomic fluid and others. 2824

Suyehiro, Yasuo, Shizuo Yoshino, and Yoshikazu Taukamoto.
Movement of the fish in response to sound stimuli with reference to sound intensity. 2568

Suzuki, Otohiko, Tasae Kawakami, and Kaoru Mitsuhashi.
General theory of fishermen's current measuring device, Siomiito. 2834

Swain, F. M., and R. W. Meader.
Bottom sediments of Southern part of Pyramid Lake, Nevada. 2488

Swarup, H.
States in the development of the stickleback Gasterosteus aculeatus (L.) 2469
Abnormal development in the temperature-treated eggs of Gasterosteus aculeatus (L.); I. Cleavage abnormalities. 2730

Swift, D. R.
Seasonal variation in the activity of the thyroid gland of yearling brown trout Salmo trutta Linn. 2339

Sykes, James E., and Gerald B. Talbot.
Atlantic coast migrations of American shad. 2184

Symmons, S., and L. L. De Kock.
A ligament in the dorsal aorta of certain fishes. 2747

Szubinska, Kilarska B.
The adipose fin in salmonidae. 2613

Tabata, K., Y. Matsue, and T. Endo.
Effect of an insecticide, parathion, on aquatic animals at lower ranges than its lethal concentration. 2820

Taguchi, Kisaburo.
A report of drift-bottle surveys off Kamchatka, USSR in 1940 and 1941. 2789
Seasonal variation of the good fishing area of salmon and the movements of water masses in the western North Pacific. II. The distribution and migration of salmon population in offshore waters. 2790
The seasonal variation of the good fishing area of salmon and the movements of water masses in the waters of western North Pacific. I. Distribution and movement of water masses. 2843

Takahashi, Masao, Masayoshi Hatanaka, and Goro Murakawa.
Experimental studies on the feeding habits of amberfish, Seriola quinqueradiata T. et S. 2313

Takase, Masuo, Masanori Chigusa, and Makoto Hirose.
Detection of the withered tree below the surface by the ultrasonic echo sounder. 2608

Takehiko, Nakamura.
River pollution by sulphide mine wastes. 2821

Talbot, Gerald B.
Research facilities the the United States Fishery Laboratory, Beaufort, North Carolina. 2379

Talbot, Gerald B., and James E. Sykes.
Atlantic coast migrations of American shad. 2184

Talling, J. F., and G. A. Prowse.
The seasonal growth and succession of plankton algae in the White Nile. 2283

Talling, J. F.
Photosynthetic characteristics of some freshwater plankton diatoms in relation to underwater radiation. 2912

Tamari, Tatuo, and Toyotake Tanoue.
Studies on the relation between the fluctuation in catch and the environmental factors of the principal fishes in Kagoshima Bay. II. In the fisheries of "Istiophorus orientalis (Teminck and Schlegel)" and sea conditions. 2516

Tamura, Tamotsu.
A study of visual perception in fish, especially on resolving power and accommodation. 2631

Tamura, T., K. Iyatomi, Y. Itazawa, I. Hanyu, and S. Sugiura.
Toxicity of Endrin to fish. 2173

Tanonaka, George K., and Mitchell G. Hanavan.
Experimental fishing to determine distribution of salmon in the North Pacific Ocean and Bering Sea. 2770

Tanoue, Toyotake, and Sumio Enami.
On the fisheries of tuna and the oceanographical conditions in the Sawu Sea. 2558

Tanoue, Toyotake, and Tatuo Tamari.
Studies on relation between the fluctuation in catch and the environmental factors of the principal fishes in Kagoshima Bay. II. In the fisheries of "Istiophorus orientalis (Teminck and Schlegel)" and sea conditions. 2516

Tappel, A. L., M. Gumbmann, and W. Duane Brown.
Intermediary metabolism of fishes and other aquatic animals. 2396

Tarr, H. L. A., and D. W. Duncan.
Biochemical studies on sockeye salmon during spawning migration. III. Changes in the protein and nonprotein nitrogen fractions in muscles of migrating sockeye salmon. 2463

Tarzwell, C. M.
Dissolved oxygen requirements for fishes. 2435
Aquatic biological investigation as a method of evaluating the self-purification of a stream. 2681

Tarzwell, C. M., C. Henderson, and Q. H. Pickering.
Relative toxicity of ten chlorinated hydrocarbon insecticides to four species of fish. 2662

Tarzwell, C. M., M. B. Ettinger, W. M. Ingram. P. W. Kabler, M. Katz, F. W. Kittrell, R. Porges, W. W. Towne, E. C. Tsivoglou, and R. L. Woodward.
A critical review of the literature of 1957 on water pollution. 2400

Tavolga, William N.
Underwater sounds produced by males of the blenniid fish, Chasmodes bosquianus. 2127

Taylor, F. W.
Measurement of flow in a small stream. 2835

Templeton, W. L.
Fission products and aquatic organisms. 2678

Terentjeva, V. D., and O. V. Mitjagina.
Determination of hardness in water using Trilon B. 2425

Terhune, L. D. B.
The Mark VI Groundwater Standpipe for measuring seepage through salmon spawning gravel. 2262

Tesch, F. W.
Nutrition and growth of Salmonidae in an impounding reservoir. 2923

Thomas, H. A.
Mixing and diffusion of wastes in streams. 2440

Thomas, J. D.
Studies on the structure, life history and ecology of the trematode Phyllodistomum simile Nybelin, 1926 (Gorgoderidae: Gorgoderinae) from the urinary bladder of brown trout, Salmo trutta L. 2243

Thompson, Richard B.
Study of localized predation on marked chinook salmon fingerlings released at McNary Dam. 2878

Timmermans, J. A.
Estimation of fish populations. 2152

Tisdall, A. L.
Chemical control of evaporation in Australia. 2324

Titova, L. K.
The development of the olfactory organ of fish and amphibians. (Razvitie Organa Obonyainya Ryb I Zemnovodnykh). 2214

Todt, F. J. P.
Electrochemical measurement of dissolved oxygen in water. 2903

Todt, F. J. P., and R. Freier.
Electrochemical measurement of dissolved oxygen in water. 2902

Tominaga, K., K. Inaba, and M. Nomura.
Studies on the improvement of artificial propagation in trout culture.--I. On the interference of the broken eggs and effect of the egg washing method. 2823

Tomlinson, Neil, and Vera M. Creelman.
Biochemical studies on sockeye salmon during spawning migration. VI. Ribonucleic acid and deoxyribonucleic acid. 2882

Tompson, Richard B.
A study of localized predation on marked chinook salmon fingerlings released at McNary Dam. 2879

Towne, W. W., M. B. Ettinger, W. M. Ingram, P. W. Kabler, M. Katz, F. W. Kittrell, R. Porges, C. M. Tarzwell, E. C. Tsivoglou, and R. L. Woodward.
A critical review of the literature of 1957 on water pollution. 2400

Trites, R. W., and L. M. Lauzier.
The deep waters in the Laurentian Channel. 2268

Tsaukamoto, Yoshikazu, Yasuo Suyehiro, and Shizuo Yoshino.
Movement of the fish in response to sound stimuli with reference to sound intensity. 2568

Tsivoglou, E. C., A. F. Bartsch, D. E. Rushing, and D. A. Holaday.
Effects of uranium ore refinery wastes on receiving waters. 2429

Tsivoglou, E. C., M. B. Ettinger, W. M. Ingram, P. W. Kabler, M. Katz, F. W. Kittrell, R. Porges, C. M. Tarzwell, W. W. Towne, and R. L. Woodward.
A critical review of the literature of 1957 on water pollution. 2400

Tsuda, Tsutomu, and Chikayoshi Matsidaira.
Studies on the analytical method of ammonia and organic nitrogen in sea water. 2216

Tsukamoto, Yoshikazu, and Shizuo Yoshino.
A study of the lateral-line system in fish. II. On the relation between the function of the lateral-line organ and the habits of fish. 2569

Tsukuda, Hiroko, and Tosiko Katayama.
Temperature adaptation in fishes. I. The influence of rearing temperature on temperature tolerance, growth rate, and body form. 2815

Tsuruta, Saburo.
Morphometric comparison of yellowfin tuna of southwestern Great Sunda Islands and of the Pacific water. 2808

Tsuyuki, H., and D. R. Idler.
Biochemical studies on sockeye salmon during spawning migration. I. Physical measurements, plasma cholesterol, and electrolyte levels. 2464

Tucker, D. S.
The distribution of some freshwater invertebrates in ponds in relation to annual fluctuations in the chemical composition of the water. 2154

Tuge, Hideomi Akira, II., Yukitaka Kanayama, and Hidemasa Ochiai.
Studies of the conditioned reflex in the lower vertebrates. I. Goldfish and sea bream (Pagrosomus major). 2467

Turoboyski, L., L. Musiał, M. Chobot, and W. Labuz.
Investigations on contamination of the Soła River and its self purification capabilities. (Badania Nad Zanieczyszczeniem Rzeki Soły I Jej Zdolnoscia Samooczyszczania). 2618

Twomey, Eileen.
Salmon of the River Shannon (1952-56). 2560

Tyler, C. P., and J. H. Karchmer.
Portable analyser for determination of dissolved oxygen in water. Application of rapid-dropping mercury electrode. 2927

Uchida, Richard N., and Tamio Otsu.
Sexual maturity and spawning of albacore in the Pacific Ocean. 2398
Study of age determination by hard parts of albacore from central North Pacific and Hawaiian waters. 2399

Underhill, James C., and David J. Merrell.
Intro-specific variation in the bigmouth shiner (Notropis dorsalis). 2345

Uzmann, J. R., and M. N. Hesselholt.
Teratological hermaphroditism in the chum salmon, Oncorhynchus keta (Walbaum). 2181

Van Bemmel, A. C. V.
Fish species on the verge of extinction in the Netherlands. (Vissoorten Die Unit De Nederlandse Fauna Dreigen Te Verdwijnen). 2828

Van Dam, Levie, and Per Fredrik Scholander.
Micro gasometric determination of oxygen in fish blood. 2850

Van Dam, Levie, Per Fredrik Scholander, John Willis Kanwisher, Harold Theodore Hammel, and Malcolm Stephen Gordon.
Supercooling and osmoregulation in arctic fish. 2832

Van Overbeek, J., W. J. Hughes, and R. Blondeau.
Acrolein for the control of water weeds and disease-carrying water snails. 2634

Various Authors.
The effects of atomic radiation on oceanography and fisheries. 2478

Velz, C. J.
Significance of organic sludge deposits. 2438

Vernon, E. H., and R. A. Crouter.
Effects of black-headed budworm control on salmon and trout in British Columbia. 2392

Vinberg, G. G., T. N. Godnev, and V. I. Gaponenko.
The experimental use of radioactive phosphorus in the study of pond fertilization. (Opyt Primeneniya Radioizotopa Fosfora Pri Izuchenii Udobreniya Prodov). 2236

Vine, A., and T. Folsom.
The effects of atomic radiation on oceanography and fisheries. Chapter Subject: Tagged water masses for studying the oceans. 2478

Vinogradova, Z. A.
The biochemical composition of the Black Sea plankton. 2401

Vivier, Paul.
An example of ancient acclimatization: The coregonids of the lakes of the Massif Centrale. (UN Exemple D' Acclimatation Ancienne: Les Coregones Des Lacs Du Massif Central). 2795
Importance of biological tests for the protection of rivers against pollution. 2922
Vladykov, Vadim D.
Distant recaptures of shad (Alosa sapidissima) tagged in Quebec. 2461
Vladykov, Vadim D., and G. Beaulieu.
Variations in the annual abundance, in Quebec, of fishes native to the Great Lakes. (Variations Dans le Quebec de L'Abondance Annuelle des Poissons Originaires des Grands-Lacs.) 2601
Vliet, R. V.
Effect of heated condenser discharge water upon aquatic life. 2156
Voss, Gilbert L., Elizabeth C. Alexander, and Thomas W. McKenney.
Early development and larval distribution of the carangid fish, Caranx crysos (Mitchill). 2201

Wada, Tsuguyasu, and Mamoru Kusa
X-ray diffraction patterns from the egg membrane of the egg of the brook trout. 2323
Wahl, Richard W., and Harvey B. Beall.
Trapping bluegill sunfish in West Virginia ponds. 2758
Wahle, Roy J., and Robert R. French.
Biology of chinook and blueback salmon and steelhead in the Wenatchee River system. 2772
Waldichuk, Michael.
Drift bottle observations in the Strait of Georgia. 2263
Walford, Lionel A.
Some problems for biological fishery survey and techniques for their solution. A sympositechniques held at Biarritz, France. March 1-10, 1956. 2829
Wallen, I. E., W. C. Green, and R. Lasater.
Toxicity to Gambusia affinis of certain pure chemicals in turbid waters. 2462
Wallis, Orthello L., Willis A. Evans, and Glenn D. Gallison.
Fishes of Yosemite. 2294
Warner, Kendall.
Migration of landlocked salmon in the Fish River Lakes, Maine. 2374
Warren, C. E., and P. Doudoroff.
The development of methods for using bioassays in the control of pulp mill waste disposal. 2449
Warren, Charles E., Max Katz, and Austin Pritchard.
Ability of some salmonids and a centrarchid to swim in water of reduced oxygen content. 2861
Warren, P. J.
Description of an improved rotating counter for zooplankton. 2431
Watanabe, Nobuo.
On the mechanism of variation in water temperature and chlorinity of upper layer in the seas south-west off Kyushu and around Nanseishoto. 2725
Watson, D. G., and J. J. Hanford Davis.
Concentration of radio-isotopes in Columbia River whitefish in the vicinity of the Hanford atomic products operation. 2921
Watson, S. W., Raymond W. Guenther, and R. R. Rucker.
Etiology of sockeye salmon "virus" disease. 2402
Ways, H. C., and D. S. Davis.
Solubility and percentage saturation of oxygen in water. 2904
Weatherley, A. H.
Growth, production, and survival of brown trout in a large farm dam. 2142
Webb, F. E.
Aerial chemical control of forest insects with reference to the Canadian situation. 2390
Webster, Dwight A., William G. Bentley, and James P. Galligan.
Management of the Lake Trout Fishery of Cayuga Lake, New York, with special reference to the role of hatchery fish. 2363
Weinreb, Eva Lurie.
Studies on the histology and histopathology of the rainbow trout, Salmo gairdneri irideus. I. Hematology: Under normal and experimental conditions of inflammation. 2609
Studies on the histology and histopathology of the rainbow trout, Salmo gairdneri irideus. II. Effects of induced inflammation and cortisone treatment on the digestive organs. 2740
Weisel, George Ferdinand.
The osteology of Mylocheilus caurinum x Ptychocheilus oregonese, a cyprinid hybrid, compared with its parental species. 2610
Wendler, Henry O.
Migration and fishing mortality rates of Columbia River Spring Chinook Salmon in 1955. 2877
Wennekens, M. P.
Water mass properties of the Straits of Florida and related waters. 2636
Westlake, D. F.
The effects of biological communities on conditions in polluted streams. 2447
Westley, R. E.
An automatic water sampler for marine shore stations. 2844
Wharton, J. C. F.
A preliminary report on new techniques for the artificial fertilization of trout ova. 2295
White, C. E., Jr.
Selectivity and effectiveness of certain types of commercial nets in the T. V. A. Lakes of Alabama. 2860
Whitney, Richard R.
Numbers of mature walleyes in Clear Lake, Iowa, 1952-3, as estimated by tagging. 2517
Wickett, W. P., and D. F. Alderdice.
A note on the response of developing chum salmon eggs to free carbon dioxide in solution. 2251
Review of certain environmental factors affect-

ing the production of pink and chum salmon. 2264
Wiegert, Lawrence, Elmer Herman, Warren Wisby, and Milton Burdick.
The yellow perch, its life history, ecology, and management. 2376
Wigley, Roland L.
Life history of the sea lamprey of Cayuga Lake, New York. 2766
Wilber, Charles G.
Chromatic responses of Fundulus to lysergic acid. 2458
Wilke, Ford, and A. J. Nicholson.
Food of porpoises in waters off Japan. 2479
Wilkins, Charles H., and William S. Richardson.
An airborne radiation thermometer. 2502
Wilkinson, G. N., Jr.
Transporting small live trout in sealed polyethylene bottles. 2176
Williams, George C.
Ovary weights of darters: A test of the alleged association of parental care with reduced fecundity in fishes. 2302
Williams, Lovett E., John D. Kilby, and Edward Crittenden.
Several fishes new to Florida freshwaters. 2299
Williams, Walter R.
The fishery for herring (Clupea pallasii) on Puget Sound. 2873
Williams, Wells E.
Food conversion and growth rates for largemouth and smallmouth bass in laboratory aquaria. 2867
Willis, Virginia M., and T. R. Rice.
Uptake, accumlation and loss of radioactive Cerium-144 by marine planktonic algae. 2779
Winn, Howard E.
Comparative reproductive behavior and ecology of fourteen species of darters (Pisces:Percidae). 2890
Biology of the brook stickleback Eucalia inconstans (Kirtland). 2939
Winn, Howard E., and James A. Haley.
Observations on a lernaean parasite of freshwater fishes. 2868
Wirth, Thomas, Wallace Niemuth, and Warren Churchill.
The walleye, its life history, ecology and management. 2377
Wisby, Warren, Elmer Herman, Lawrence Wiegert, and Milton Burdick.
The yellow perch, its life history, ecology, and management. 2376
Wisniewski, T. F.
Algae and their effects on dissolved oxygen and biochemical oxygen demand. 2444
Withler, F. C., and M. P. Shepard.
Spawning stock size and resultant production for Skeena sockeye. 2261
Witt, Arthur, Jr., and Robert S. Campbell.
Refinements of equipment and procedures in electrofishing 2663
Wittenberg, Johathan B.
The secretion of inert gas into the swim-bladder of fish. 2221
Wohlschlag, Donald E., and Rogelio O. Juliano.
Seasonal changes in bluegill metabolism. 2539
Wolf, Ken, and C. E. Dunbar.
Methods of infecting trout with kidney disease and some effects of temperature on experimental infections. 2394
Test of 34 therapeutic agents for control of kidney disease in trout. 2866
Wolf, Ken, and Robert G. Piper.
Cost of disease treatment. 2757
Wood, J. D.
Biochemical studies on sockeye salmon during spawning migration. IV. The non-protein nitrogenous constituents of the muscle. 2465
Nitrogen excretion in some marine teleosts. 2584
Wood, James W., and Erling J. Ordal.
Tuberculosis in Pacific salmon and steelhead trout. 2362
Wood, R. D.
A naturally occurring visible thermocline. 2356
Woodall, A. N.
The missing links in fish husbandry. 2669
Woodward, R. L., M. B. Ettinger, W. M. Ingram, P. W. Kabler, M. Katz, F. W. Kittrell, R. Porges, C. M. Tarzwell, W. W. Towne, and E. C. Tsivoglou.
A critical review of the literature of 1957 on water pollution. 2400
Wooster, W., and B. Ketchum.
The effects of atomic radiation on oceanography and fisheries. Chapter Subject: Transport and dispersal in the sea. 2478
Worthington, L. V.
The 18° water in the Sargasso Sea. 2532
Wright, John C.
The limnology of Canyon Ferry Reservoir. I. The phytoplankton-zooplankton relationships in the Euphotic Zone during September and October, 1956. 2277
Limnology of Canyon Ferry Reservoir II. Phytoplankton standing crop and primary production. 2776
Wurtz, Charles B., Thomas Dolan, and Colton H. Bridges.
Survey of multiple-use reservoir practices in the United States. 2665

Yamabayashi, Isamu, and Hiromu Kobayasi.
On the acceleration of spawning in a loach, Misgurnus anguillicaudatus (Cantor), by injection of the hypophyses on the same species. 2567
Yamamoto, Tokio.
Artificial induction of reversal in sex-differentiation of the Medaka, Oryzias latipes. 2215
Artificial induction of functional sex-reversal in genotypic females of the Medaka (Oryzias latipes). 2853
Yamashita, Y., Y. Hiyama, and T. Kusaka.
Fishing effect of a model lift nets, with regard to relation between mesh size and fish length. 2846
Yanagimachi, Ryuzo.

Some properties of the sperm-activating factor in the micropyle area of the herring egg. 2572

Yashouv, A.
Biological data on Tilapia galilaea and Tilapia nilotica in the fish ponds. 2140
On the possibility of mixed cultivation of various Tilapia with carp. 2297
Winter culture of carps at the fish culture research station--Dor. 2350
The excreta of carp as a growth limiting factor. 2351
Acclimatization of new species in the fishponds of the station. 2354

Yashouv, A., and A. Hefetz.
A key to the tilapia species found in pond areas. 2739

Yasuda, Hideaki.
Implications of the scale ring. --1. The phenomenon of unformed rings on the scales. 2311

Yoneda, Y., and Y. Yoshida.
Physiological and ecological studies on red tide --1. On the vertical migration of the plankton producing red tide. 2786

Yoshida, Y., and Yoneda, Y.
Physiological and ecolgical studies on red tide --1. On the vertical migration of the plankton producing red tide (1). 2786

Yoshihara, Tomokichi.
On the type of frequency curve of the catch--II. 2615

Yoshimuta, Chosei, and Shinsuke Mitsugi.
Effect of supersonic wave on behavior of fish. 2583

Yoshino, Shizuo, Yasuo Suyehiro, and Yoshikazu Tsukamoto.
Movement of the fish in response to sound stimuli with reference to sound intensity. 2568

Yoshino, Shizuo, and Yoshikazu Tsukamoto.
A study of the lateral-line system in fish. II. On the relation between the function of the lateral-line organ and the habits of fish. 2569

Young, E. Gordon, D. G. Smith, and W. M. Langille.
The chemical composition of sea water in the vicinity of the Atlantic Provinces of Canada. 2364

Young, Nelson, E. Lovell Becker, Robert Bird, John W. Kelly, John Schilling, and Sidney Solomon.
Physiology of marine teleosts. I. Ionic composition of tissue. 2357
Physiology of marine teleosts. II. Hematologic observations. 2358

Zarnecki, S.
Population of Silesian Vistula trout spawners in 1954. (Poglowie Tarlakow Pstraga Z Wisly Slakiej Z Roku 1954). 2809

Zhuravel', P. A.
A mysis that is new for the Dnepr Reservoir (Novaya Dlya Sistemy Dnepra Mizida-Hemimysis Anomala Sars V Dneprovskim Vodokhranilishche). 2749

Zocchi, Rodolfo.
Insects injurious to fish culture. (Insetti Dannosi in Pescicoltura). 2518

Zotin, A. I.
The membrane hardening enzyme of salmon eggs (Ferment Zatverdevaniya Obolochek U Yaits Lososevykh Ryb). 2412
The mechanism of hardening of the salmonid egg membrane after fertilization or spontaneous activation. 2563

++++++++++++++++++++++++++++

SUBJECT INDEX VOLUME IV

Abramis brama (see Bream)
Abrams Creek, reclamation of, 2767
Absorption, Calcium-45 and Strontium-90, 2710
Abundance,
plankton, influence of organic matter on, 2793
salmon, sockeye, of young, 2247
variation in annual, 2601
Acaracides, toxicity to Lebistes, 2165
Acclimatization,
new species in fish ponds, 2354
preferred temperature, influence on, 2275
salmon in the basin of the Bering Sea, 2714
trout, rainbow, ecological and ethological response to, 2513
Acid(s),
amino,
changes in composition of protein of trout eggs, 2802
test diet for chinook salmon, 2851
deoxyribonucleic, in sockeye salmon, 2882
discharge from lignite pit, 2378
ribonucleic, in sockeye salmon, 2882
tar, effect on synthetic fiber fishing twine, 2727
Acoustical, reflection of sound by swimbladder, 2240
Acoustics, fish of, 2146
Acrolein, control of water weeds and snails, 2634
Activity, mortality caused by severe muscular, 2273
Adaptation, locomotor performance of chum salmon fry during osmoregulatory, 2744
Administration, pollution abatement program, 2434
Aeration,
rate of factors affecting, 2439
surface, reaeration, 2556
theory for determining coefficient of, 2437
turbine, to increase purification capacity of stream, 2905
Aeromonas salmonicida (see Furunculosis)
Age, (see also Life history and growth),
albacore, determination using hard parts, 2399
bluegill, 2325
menhaden, 2537
otoliths, 2562
salmon, 2578
pink, a 3-year old, 2366
temperature preferred varies with, 2275
yellowtail, near Japan, 2309
Agrakhan Gulf, sturgeon breeding, 2700
Aircraft, sea surface temperature measures from, 2502
Alaska,
fishery management and research, 2852
life history of threespine stickleback in Karluk Lake and Bare Lake, Kodiak Island, 2693
Albacore,
adaptation of water temperatures for, 2825
age determination, use of hard parts, 2399
maturity and spawning of, 2398
thyroid, anatomical and histological study of, 2491
Albula vulpes (see Bonefish)
Alcohol,
cetyl,
effectiveness for evaporation control, 2324
evaporation retardent as, 2148
stearyl, as evaporation retardent, 2148
Algae,
bloom, sewage discharge created, 2432
control of,
chemicals, by, 2908
CMU, with, 2160
references on, 2475, 2476
reservoir, in, 2161
survey of methods, 2427
marine planktonic, uptake, accumulation and loss of radioactive cerium-144 by, 2779
organic decomposition products, effects of, on B. O. D., 2444
plankton, method and basis for number estimation, 2456
protoplasm of, studies on, 2788
quantitative ecology of marine phytoplankton, 2526
Algicide,
2, 3-dichloronaphthoquinone, 2427
2, 4-D, toxicity to fish, man and livestock, 2427
Alkalinity,
bottom fauna, influence of, 2129
carp spawning favored by low, 2511
determination, in sample with, pH, Ca, and Mg, 2424
pH, 2899
Alosa sapidissima (see Shad, American)
Amberfish (see Yellowtail)
Ambloplites rupestris (see Rock bass)
Ameiurus, effects of X-rays on taste barbel regeneration, 2616
Amino acid, composition of protein or egg and young of Rainbow Trout, 2632
Ammonia, determination in sea water, 2216
Ammonium sulfate, toxicity to laver cell of, 2788
Anadromous fishes,
California of, 2892
summer and winter races among, 2886
Analysis, plankton, in highly turbid water, 2149
Anatomy,
neurosecretory tract development, 2466
thyroid,
albacore of, 2491
bluefin tuna of, 2491
Anchovy, behaviors of shoals of, 2836
Anoxia, toleration to, of carp, 2238
Antibiotics, terramycin for fin rot, 2676
Aorta, dorsal, a ligament in of certain fishes, 2747
Apalachicola Drainage, freshwater decapod crustaceans of, 2534
Apatemon gracilis pellucidus, life cycle of, 2862
Apparatus,
analyser, portable for dissolved oxygen, 2927
electrode, rapid-dropping mercury for dissolved oxygen, 2928
measuring, current, 2834
oxygen content of waste waters, to record, 2684

Apparatus, cont.
recorder, electrical for dissolved oxygen, 2901
sampler, automatic water, 2844
Aquaria, to recirculate sea water, 2677
Aquatic(s)
organisms, fission products and, 2678
plants,
acrolein for control of, 2634
addition to fish food, 2702
controlling in fish ponds, 2682
depleting littoral oxygen, 2596
Arctic,
fish, supercooling and osmoregulation, 2832
lakes, limnology in relation to water supply, 2911
Arctic Unit, station list of Fisheries Research Board of Canada, 2881
Argulus, control with Lindane in ponds, 2298
Arripis trutta, population of in Australian waters, 2775
Artemia, nauplius, swimming and feeding of, 2335
Ash, content of plankton, 2401
Atlantic,
coastal fishery resources, can we manage? 2864
young jack crevalles of southeastern coast of U. S., 2761
Attheyella northumbrica, synonomy of, 2410
Audibility, directional through one lateral line, 2831
Australian waters, populations of Arripis trutta, 2775

Backwater lakes, fish populations of, 2660
Bacteria,
bacteriostatic power of malachite green against, 2623
influence, on oxygen distribution, 2551
phosphate concentration, relation to, 2322
populations in sea water, 2536
Pseudomonas, ecology of some types of, 2451
standing crop of in lake sediments and its place in lake classification, 2781
Bacteriological, contamination of the Niemen River, 2619
Baffle, fishway, 2642
Bahamas,
digenetic trematodes of marine fishes from, 2734
toadfish, a new, from, 2737
Balanus, nauplius, swimming and feeding of, 2335
Baltic Sea, fishery, expansion needed, 2416
Barbel, effect of X-rays on regeneration, 2616
Barkley Sound,
distribution of juvenile herring, effects of environment on, 2651
relationship of juvenile to adult herring, 2652
Barracuda, great, life history and systematics of, 2647
Bass,
largemouth,
homing behavior of displaced, 2303
stocking ratios for ponds studied, 2460
Bass, cont.
largemouth and smallmouth,
food conversion and growth rates of in aquaria, 2867
smallmouth, habitat and associated fauna, 2371
striped, introduction possible in Spain, 2509
white, recorded in Florida, 2299
Bathymetry, Gibbs Hill area, Bermuda, 2531
Behavior,
adaptation, light and dark, Pacific salmon, 2253
aggressive,
development and display, juvenile trout and salmon, 2290
northern pike during spawning, 2291
blennoid (Chaenopsis ocellata), 2736
breeding, relation to ecological background, 2336
competition, in juvenile salmon and trout, 2290
conditioned,
defensive, established in larvae, 2468
light with food, studies of, 2467
conditioned reflex, motor-food, lateral line physiology, 2242
courtship, sounds of male blenniid, 2127
feeding, diurnal rhythm, factors influencing, 2519
fishes entering trap nets, 2589
habitat preference, experimental study of, 2489
"homing",
displaced centrarchids, of, 2303
following artificial spawning and displacement, 2385
lake trout, none evident in, 2195
laboratory for study of, 2397
lateral-line organ, relation(s) to, 2569
movement(s),
correlated with pressure and rainfall, 2349
innate, to spawning grounds, 2349
restricting fish populations, 2525
sound, in response to, 2568
object detection by electric fish, 2241
Pacific sardine, 2658
reproductive of darters, 2890
school(s),
anchovy, 2836
nets, near,
change of illumination, effect of, 2813
colored net, effect of, 2811
depth of color of net, effect of, 2812
shoaling, 2717
social,
ayu (Plecoglossus altivelis), 2818
groupings, studies on, 2763
spawning,
bluebreast darter of, 2748
northern pike of, 2291
supersonic wave, effect of on fish, 2583
swimming speed affected by temperature, 2274
temperature, preferred, influenced by acclimation level, 2275
territoriality,
development and structure, 2290
juvenile sockeye salmon in, 2300

Behavior, cont.
underwater sound, relation(s) to, 2545, 2588
Benthonic populations, correlation between, sedimenting planktonic debris, chemical characteristics of water and sediments and, 2888
Benthos,
organism development in new ponds, 2417
zoo-, biomass variation due to carp feeding, 2419
Bering Sea, acclimatization of salmon in basin, 2714
Bermuda, bathymetry of Gibbs Hill area, 2531
Bibliography,
fish,
blood chemistry, 2764
medaka (Oryzias latipes) of, 2655
fishery,
science and technology, 2800
world, 1954, 2787
plankton analysis, 2149
water resources of western U. S., 2232
Big Blue River, fishes of basin, Kansas, 2645
Bimini,
digenetic trematodes of marine fishes of, 2734
toadfish, new of, 2737
Bio-assay(s),
bacterial, possible use in productivity studies, 2189
pollution, study of method to evaluate water, 2606
pulp mill pollution control, methods for, 2449
Biochemical,
degradation products, 2595
sockeye salmon during spawning and migration, studies of, 2882
taxonomic study, application of method of analysis to, 2635
Biochemistry,
composition of plankton, 2401
muscle,
constituents, non-protein nitrogenous, 2465
nitrogen fractions, changes in migrant salmon, 2463
plasma cholesterol, of migrating salmon adults, 2464
Biological,
aspects, management of commercial marine fisheries, 2863
studies, Laguna Madre de Tamaulipas, 2819
tests, importance of for protection of rivers against pollution, 2922
Biological Station, "Borok", reorganization of, 2230
Biomass, total, seasonal variation in estuary, 2133
Blackfish, Alaskan, ecology of, 2338
Blenny, Pike, behavior of, 2731
Blood, (see also Hematology)
bibliography of chemistry of, fish, 2764
biochemical studies on fish, 2546
histology and histopathology of rainbow trout, 2609
oxygen in fish, micro-gasometric determination, 2850
Blood, cont.
Salmo gairdnerii,
chromium-induced changes in, 2918
severe muscular activity, changes in following, 2876
Bluegill,
age and growth, 2325
metabolism, 2539
stocking ratios for ponds studied, 2460
tapeworm, pseudophyllidean, seasonal in, 2125
toxicity of chemicals affected by oxygen, 2445
trapping in West Virginia ponds, 2758
West Okoboji Lake, Iowa, 2599
B. O. D.
determination, effects of detergents on, 2430
effects of algae on, 2444
Body form, influence of rearing temperature on, 2815
Bonefish, metamorphosis of, 2611
Bottom fauna,
Chaplin's Lake, La. of, 2487
invertebrates from San Francisco Bay, 2528
organic pollution of New Zealand streams, 2597
polluted stream conditions, influence on, 2447
production of in Provo River, Utah, 2791
standing crop, significance of ecological factors, 2129
stream dredging, effects of on, 2876
toxaphene toxicity of, 2200
Bottom mud, use as fertilizer for land and water, 2164
Bottom sampler (see Equipment)
Bottom samples, importance of screen size in washing, 2522
Brain transection, effects on respiration, 2341
Bream (Abramis),
races, Danube and Dneiper compared, 2228
spawning and development of, 2506
Breeding,
juvenile salmon in Stora and Lilla Lule Alv, 2590
pike, 2705
sturgeon, 2700
Brevoortia tyrannus (see Menhaden)
Brine,
euryhaline species, tolerance of to, 2504
freshwater fishes, tolerance of certain to, 2524
Brine shrimp, test animal to evaluate water pollution, 2606
Budworm,
blackheaded, spraying evaluation of, 2390
spruce, spraying evaluation of, 2390
Bullhead, brown, hearing, relation of swimbladder to, 2332

Caesium, radioactive, absorption by soil and sand, 2453
Calanus, nauplius, swimming and feeding of, 2335
Calcium,
blood, measured in migrating salmon, 2335
determination in same sample with pH, Mg, and alkalinity, 2424
egg wash with, 2295
invertebrate fauna, relation to, 2154
serum, effect of estradiol on, 2138

Calcium, cont.
water content, relation to strontium-90 uptake, 2454
Calcium-45,
comparative absorption by young salmon, 2710
uptake, of wild and lordotic guppies, 2222
Calcium carbonate, organic productivity and solubility product of in the ocean, 2841
California,
freshwater and anadromous fishes of, 2892
inland angling estimates for 1954, 1956, and 1957, 2641
kelp harvesting, history of in, 2891
offshore fishes of, 2856
vertical baffle fishway, 2642
Calories, diet content, for trout, 2380
Canada,
Arctic unit station list of, 2881
freshwater fishes of, 2858
uncommon and unusual fishes of east, 2885
Capacity,
fishway, 2768
problem of fishway, 2694
purification of stream, method of increasing, 2905
Caranx crysos (see Runner, blue)
Caranx ruber, added to list for Cedar Key, Fla., 2494
Caranx sp. (see cravalle, jack)
Carassius auratus (see Goldfish)
Carbon-14,
organic matter cycle, study by, 2845
organic productivity and solubility product of $CaCO_3$ by, 2841
photosynthetic activity of water masses, measure by, 2840
Carbonate, changes in of blood of trout, 2880
Carbon dioxide,
blood content relation to oxygen tension, 2455
egg utilization of O_2 independent of, 2251
microtonometric determination of, 2340
relation to oxygen consumption, 2372
Carbon disulfide, for echoless-wall of aquarium, 2545
Carp,
ecology and use in Utah, 2147
eggs discharged, relation of to ovarian eggs at primary spawning, 2602
fishing effects of model lift nets on, 2846
fry, transporting in plastic bags, 2353
growth, excreta limiting factor for, 2351
hemoglobins, multiple, in, 2307
Indian (Catla catla), survival rate, 2897
Indian major, factors influencing spawning of, 2511
insecticides, effectiveness of on young, 2799
phenomenon of tobikoi or "shoot" carp, 2629
spawning observations, India, 2343
toxicity of endrin to, 2173
winter, temperature limiting factor for, 2350
yields increased, mixed with Tilapia, 2297
Carpiodes carpio carpio (see Carpsucker, northern river)
Carpsucker, northern river, food habits of, 2175
Castillian Harbor, climatic and thermic data in relation to fishing, 2839
Catch, (see also Harvest)
California inland angling estimates, 1954, 1956, and 1957, 2641
curve, analysis of a, 2745
frequency curve of, 2615
hatchery releases of salmon, contributions of to, 2879
measurement of factors affecting in minnow seine, 2600
school of tuna deduced from distribution of, 2797
Catching, technique in Baltic salmon, 2699
Catfish,
channel,
abundance relative to flathead catfish, 2227
harvest rate of, 2512
movement in river, 2209
tolerance to PMA, 2170
Clariidae, new genus and species of, 2334
flathead,
growth of, 2227
propagation of, 2673
Indian, action of enzymes on the gonadotrophic activity of pituitary extracts of, 2801
skull development of, 2470
spawning induced with mammalian hormones, 2490
X-rays effect on taste barbel regeneration of, 2616
Catostomid, a new from Green River, Kentucky and Tennessee, 2729
Catostomus commersoni (see Sucker, white)
Cayuga Lake, life history of sea lamprey of, 2766
Centrarchid(s),
ability to swim in water of reduced oxygen content, 2861
homing of displaced, 2303
Centropristes sp. (see Seabass)
Cercaria, migration in intermediate host, 2319
Cerium, radioactive, absorption by organisms, 2453
Cerium-144, uptake, accumulation and loss of by marine planktonic algae, 2779
Cestode, new genus and species, in elasmobranchs, 2318
Cetyl alcohol, evaporation reduction in reservoirs, 2148
Chaenopsis ocellata (see Blenny, pike)
Chaetognatha, inshore waters of North Carolina, 2279
Chaoborus larvae, limnetic distribution of, 2482
Char, occurrence in Sweden, 2816
Check-list,
freshwater and anadromous fishes of California, 2892
freshwater fish of Canada and Alaska, 2473
Chemical,
characteristics, water and sediments, correlation with sedimenting plankton debris and benthonic populations, 2888
conditions, River Jumna at Allahabad, 2895
factors,

Chemical,
factors, cont.
growth limiting on phytoplankton, 2481
interrelation with physical, 2459
relation to pond productivity, 2460
observations, Iglooslik in Arctic circle, 2884
properties, sea water, 2924
Chemistry, (see also Limnology and Oceanography)
Gulf of Mexico, data for, 2403
invertebrate fauna, relation to, 2154
Chloramines, toxicity to rainbow trout, 2909
Chlorine,
algaecide for reservoirs, 2161
algae control, use of, 2427
removal from tap water, 2477
toxicity to rainbow trout, 2909
Chlorinity, (see also Salinity, Oceanography)
Atlantic Ocean water near Canada, 2364
seas southwest of Kyushu and around Nanseishoto, variation in, 2725
vertical distribution, relation to swimming layer of tuna, 2827
waters of Bering Sea and Aleutian region, 2144
Chlorophyll, in mountain river, 2784
Cholesterol, changes during spawning migration, 2372
Chromium-induced changes in rainbow trout, 2918
Chromatic, response to lysergic acid, 2458
Classification, (see Taxonomy)
Classification, lakes, 2781
Climatic data, relation to fishing, 2839
Clinostomus elongatus (see Dace)
Clupea pallasii (see Herring)
CMU,
algae control with, 2160
toxicity to fish, 2160
Cod nematodes, larval, identity of in muscles of, 2321
Coelomic fluid, pH value of rainbow trout, 2824
Colored nets,
behavior of fish schools near, 2811
depth of hue of, effect on behavior of fish school, 2812
driving fish with, 2814
illumination change of, effect on behavior of fish school, 2813
passage of fish through, 2810
Columbia River,
chinook salmon, migration and fishing mortality rates of, 2877
whitefish, concentration of radio-isotopes in, 2721
Commercial fisheries, laws and regulations of, Alaska, 2375
Commercial-sport harvests compared, 2301
Competition, (see also Behavior) food for, between two coregonids, 2293
Conductivity, electrical of sea-water, effect of pressure on, 2838
Continental margin, between Brittany and Ireland, 2530
Control, chemical, of aquatic nuisances, 2908
Coos Bay, oxygen anomalies in surf, 2523
Copepod(s),
Lernean parasite of freshwater fishes, 2868
vertical distribution of some inshore, 2637
Copper naphthenate, preserving effects of for fishing nets, 2726
Copper sulfate,
algaecide for reservoirs, 2161
red tide control with, 2193
Coregonidae, taxonomic study by biochemical method, 2635
Coregonids, of lakes of Massif Centrale, 2795
Coregonus clupeaformis (see Whitefish, lake)
Corrosion, resistance to, of tag pins, 2191
Coryphaena equiselis (see Dolphin, pompano)
Coryphaena hippurus (see Dolphin, common)
Cranium, development of, catfish, 2470
Crayfish,
Apalachicola drainage, 2534
distribution and taxonomy in California, 2361
Creel census,
Des Moines River, 2512
fishery condition evaluation, 2143
Crevalle, Jack, young off southeast Atlantic Coast of U. S., 2761
Cricotopus bicinetus (see Midgefly)
Croaker, Atlantic, migration of, 2301
Crustacean nauplius, swimming and food of nauplius larvae, 2335
Crustacean(s),
Attheyella northumbrica, synonomy of, 2410
decapods of Apalachicola drainage, 2534
Euphausiidae at southwest Sakhalin coast, 2708
resistance of to sodium chromate, 2915
Ctenopharingodon idellus, 2354
Cultivation, Daphnia magna, 2711
Culture(s)
controlled spawning and genetic selection, effects of on future fish, 2667
toxin poisonous fish in bacteria-free, 2680
Current(s),
artificially induced, effects on stratified lakes, 2407
Bering Sea and Aleutian region, 2144
dominant flow element, 2265
drift-bottle surveys off Kamchatka, 2789
fisherman's measuring device, 2834
Lake Huron, 2683
Lake Mendota, Second Point Bar, 2538
Straits of Florida, 2636
surface,
drift bottle returns, 2183, 2254, 2263
studies of Saginaw Bay and Lake Huron, 2194
Cynoglossus lingua, life history of, 2134
Cynoscion regalis (see Weakfish, grey)
Cyprinid, osteology of hybrid, 2610
Cyprinidae,
densities of, 2719
swimbladder in, physical properties of isolated, 2720
Cypriniformes, physical properties of swimbladder in intact, 2718
Cyprinus carpio (see Carp)

Dace, food, growth and sexual dimorphism of, 2750
Daphnia magna, cultivation, 2711
Dalapon, toxicity to fish, man, and livestock, 2427
Dallia pectoralis (see Blackfish, Alaskan)
Dam,
Alder, survival of downstream migrant salmon passing, 2874
McNary, predation on chinook salmon fingerlings released at, 2878
Darter(s),
bluebreast, spawning behavior of, 2748
comparative reproductive behavior and ecology of 14 species of, 2890
fecundity relations in, 2302
Daylight, direct effect on growth, 2182
DDT,
secondary effect upon aquatic microflora and microfauna, 2552
spraying, aerial, effects on fish, 2391, 2392
toxicity, compared to Sevin, 2492
Decline, yellowtail flounder, 2697
Decomposition, organic, effects on freshwater algae, 2150
Density, Cyprinidae of, 2719
Density measurement, by suspended plummet method, 2501
Depth,
-finder, for fishing tools, 2614
Gibbs Hill area, Bermuda, 2531
recorder for use at sea, 2689
Destruction, fish in the Ruhr, 2906
Detergent(s),
pollution, origin and importance of foaming, 2430
toxicity of synthetic to fish, 2916
use in diatom slide preparation, 2498
Development,
chum salmon, 2854
Mazocraeoides olentangiensis, a parasite of the gizzard shad, 2648
mullet, reproductive tissues of, 2738
olfactory organ, 2214
power, fish problems of, 2889
sand sole, larvae, 2875
sea-trout, temperature influence on respiratory metabolism during, 2855
ten-pounder, 2765
Diatoms,
Bering Sea and North Pacific Ocean, distribution of in, 2317
plankton, photosynthetic characteristics in relation to underwater radiation, 2912
seasonal change of, in Kogoshima Bay, 2557
slide preparation suggestions, 2498
Dieldrin, effects on fisheries, 2515
Diet, (see also Nutrition)
amino acid test for chinook salmon, 2851
calorie content reduction possible for trout, 2380
dry, for chinook salmon, 2675
hatchery rainbow trout, 2653
salmon size differential caused by, no racial,
Diet, cont.
2422
virus disease source in, 2404
Dinitrocarbazole, toxicity to fish, 2686
Diplostomum spathaceum larvae, carp infested, in Russian reservoir, 2415
Disease(s),
Ichthyosporidium, rainbow trout, 2471
kidney, experimental infections, methods, 2394
missing links in fish husbandry, 2669
prophylaxis, constant-flow siphon for, 2389
Terramycin for fin rot, 2676
treatment, cost of, 2757
trout,
brook, ulcer and furunculosis, 2753
kidney, control of, 2866
rainbow,
bacteriostatic power of malachite green, 2623
two-year-olds reared on artificial food, 2704
tuberculosis, in Pacific salmon and rainbow trout, 2362
vibrio, of Pacific salmon and rainbow trout, 2382
"virus", etiology of sockeye salmon, 2404
water- and food-borne, 2382
Disinfectants, effect on fish and animals serving as food, 2917
Distribution,
American shad, extension of range, 2894
bass, white, new to Florida, 2299
chaetognatha, North Carolina, 2279
Chaoborus in a lake, limnetic, 2482
char (Salmo alpinus) in Sweden, 2816
copepods, vertical, 2637
crayfish, of California, 2361
diatom, Bering Sea and North Pacific Ocean, 2317
dolphins (Coryphaina hippurus and C. equiselis) 2746
fish,
Basin of Arcachon, of, 2231
Big Blue River, Kansas, 2645
Belfort Region, France, of, 2224
Chautauqua, Cowley, and Elk Counties, Kansas, 2644
Congaree River, South Carolina, of, 2244
freshwater,
Africa of, 2229
Canada and Alaska, of, 2473
Great Lakes Region, 2612
North Pacific Ocean, of, 2246
Potomac-Shenandoah River, system, Virginia, 2646
River Sone, of, 2126
Upper Kisatchie Drainage, Louisiana, 2565
Yosemite National Park, of, 2294
herring, juveniles in Barkley Sound, 2651
muskellunge, in Tennessee streams, 2871
mysis, in Dnepr Reservoir, 2749
ostracods, Lower Chattahoochee-Flint Basin, 2535
perch, yellow, new to Florida, 2299

Distribution, cont.
plankton,
apparatus for study of spatial, 2500
horizontal, 2546
North Twin Lake, of, 2219
N. W. Pacific Ocean, of, 2235
rainbow trout, Paul Lake, B. C., 2649
runner, blue, larval, 2201
salmon,
fishing to determine in North Pacific and Bering Sea, 2770
north Pacific Ocean, 2316
offshore waters in, 2790
Siluroidei of Chile, 2496
species,
list for Florida, 2495
two, added to list for Cedar Key, Florida, 2494
sunfishes, new to Florida, 2299
swordfish, northwest Pacific Ocean, 2848
uncommon and unusual fishes, eastern Canada, 2885
vertical, of particulate matter, 2346
water masses, 2843
zooplankton, in summer, in estuaries, 2420
Diving, studies of marine sewage and industrial effluents, 2450
Dnepr, a mysis new for, 2749
Doctoral, dissertations on management and ecology of fishes, 2696
Dolphin,
common, identification, distribution and biology, 2746
pompano, identification, distribution and biology, 2746
Dredging,
lake, ecological effects on fish, 2485
stream, effects of on young silver salmon, 2876
Drift bottles,
current, surface, studies of, 2194
surveys off Kamchatka, 2789
Drought, responses of minnows to, 2210
Drugs, nitrofuran compounds, for furunculosis, 2384

Ecology, (see also Limnology, Oceanography)
Blackfish, Alaskan, 2338
bottom fauna standing crop, factors influencing, 2129
carp, in Utah, 2147
darters, 14 species of, 2890
doctoral dissertations on, 2696
dredging effects on lake, 2485
Gulf of Panama, 2122
invertebrates of San Francisco Bay, 2528
organisms, effects on polluted streams, 2447
perch, yellow, 2376
pollution's biological effects, 2446
ponds, acid, study of strip mine, 2406
Pseudomonas types in a lake, 2451
quantitative of marine phytoplankton, 2526
Sheepscot River estuary, 2773
trout, rainbow, acclimatization relations of, 2513
Ecology, cont.
walleye, yellow, 2377
weakfish, gray, in estuary, 2249
Economic(s),
carp of in Utah, 2147
management of commercial fisheries, aspects of, 2863
quota control, effects of on, 2287
sport fishing industry, value of, 2515
Eels, Moray, role of senses in the feeding of, 2735
Effectiveness, commercial nets in the T. V. A. lakes of Alabama, 2860
Egg(s), (see also Fecundity, Life history)
carp, 2602
culture, jar, of trout, 2383
fishes of Indian waters, 2896
Gasterosteus aculeatus, cleavage abnormalities of, 2730
herring, 2572
membrane, X-ray diffraction of, 2323
number, no relation to fish size, 2174
response to free CO_2 in solution, 2251
salmon, 2586
salmon, membrane hardening enzyme, 2412
salmonid, 2563
size, related to fish size, 2174
stickleback, 2579
sturgeon, 2712
trout,
interference of broken and effect of egg washing method, 2823
pH value, 2824
rainbow, 2632
rainbow, changes in amino acid composition of protein of, 2802
Egg-taking, method using air injection, 2295
Elasmobranch parasite, new cestode in, 2318
Electric field,
leading adult squawfish within an, 2769
object detection by disturbance of a fish's, 2241
Electricity,
alternate-polarity electrode modifications, 2386
differences of potential, of the oceans, 2233
heart, isolated, beat rate stimulated, 2212
meter, resistivity, management uses, 2395
seine, for quantitative sampling, 2203
Electro-chemical,
dissolved oxygen, method, 2902, 2903
oxygen determination method, 2426, 2607
Electrode,
alternate-polarity, modifications of, 2386
dissolved oxygen, for measuring, 2687
rapid-dropping mercury for dissolved oxygen determination, 2927, 2928
Electrofishing,
D. C., using separate excitation, 2198
equipment and procedures, 2663
lakes in, for small fish, 2872
pulsatory direct current, 2640
salt reduction of resistivity, 2289
shocker, back-pack portable, 2199
Elodea canadensis, oxygen depletion by, 2596
Elops saurus (see Ten-pounder)

Embryology, (see also Life history)
development without water, 2521
egg membranes, X-ray diffraction of, 2323
olfactory organ development, 2214
sex reversal, artificial, with hormones, 2215
stickleback, threespine, morphological stages of, 2469
Embryos, trout, relation between yolk size and differentiation in, 2742
Endrin, toxicity of, temperature relation, 2173
Entocythere sp., Lower Chattahoochee-Flint Basin, 2535
Environment,
catch of sailfish, relation to, 2516
chemical factors, control of in, 2548
juvenile herring in Barkley Sound, 2651
salmon production, factors affecting, 2264
speciation of marine animals, relation with, 2571
Enzyme(s),
egg membrane hardening, 2412
gonadotrophic activity of pituitary extracts of Indian Catfish, action of on, 2801
Eosin, toxicity of, 2168
Epinephelus guttatus (see Hind, red)
Equation, estimating stream oxygen balance, 2443
Equipment,
chamber, counting of nannoplankton, 2327
dispensers for dry feed, mechanical, 2387
electrode changes, for safety and effectiveness, 2386
electrofishing, 2663
electrofishing, D. C., with separate excitation, 2198
facilities at U. S. research laboratory, 2379
instrument, hot wire, for turbulence measureing, 2280
meter, resistivity, management uses, 2395
pump for increasing oxygen in ponds, 2141
pushnet for quantitative sampling of shrimp, 2284
sampler,
core, portable, for lake deposits, 2281
new, lake sediment core freezer, 2130
shocker, constant-flow, for prophylactic treatment, 2389
spatial distribution, for studies of plankton, 2500
standpipe,
measure seepage thru spawning gravel, 2262
streambed seepage determination for, 2187
transporting, compared, 2353
Erosion-littoral, organic sediment in of Lake Balaton, 2794
Erythrocyte, count and size, rainbow trout, 2333
Esox lucius (see Pike, northern)
Esox masquinongy (see Muskellunge)
Estimation, mortality, natural and fishing, 2276
Estradiol benzoate, effect on serus calcium phosphorus, and protein, 2138
Estuaries, invertebrates of, in San Francisco Bay, 2528
Estuarine,
model, for predicting mill waste effects, 2218
Estuarine, cont.
zooplankton paucity due to deep turbulence, 2267
Estuary,
biomass, seasonal variation in, 2133
pollution,
fauna, effects on of, 2448
same-slack technique for quality pattern study, 2484
Sheepscot River, ecology of, 2773
zooplankton, composition and distribution in summer, 2420
Etheostoma camurum (see Darter, bluebreast)
Etiology, virus disease, sockeye salmon, 2402
Eucalia inconstans (see Stickleback, brook)
Euphausiidae, spawning population at southwest Sakhalin coast, 2708
Evaporation,
control,
alcohol, with, 2148
hexadecanol use in Australia, 2324
monolayers, influence of on, 2543, 2544
Evolution,
Atlantic salmon (Salmo salar), 2570
breeding pattern and ecology relation to, 2336
Excreta, a growth limiting factor, 2351
Excretion, nitrogen of some marine teleosts, 2584
Exploitation,
aquatic resource of, 2581
constant optimum rate not practical, 2261
rate, of lake trout, 2353
Extinction, fish species on verge of in Netherlands, 2828
Eye,
retinal responses of pink salmon, 2741
visual perception of fish, 2631

Farm ponds,
herbicides, effects of on plants and fish of, 2643
production of brown trout in, 2142
stocking ratios, 2460
Fat content,
changes during spawning migration, 2373
plankton, 2401
Fatigue,
hatchery fish, resistance to, 2653
troll-caught Pacific salmon in, 2883
Fauna,
bottom,
production in Provo River, Utah, 2791
stream dredging, effects of on, 2876
estuarine,
effect of pollution on, 2448
Fecundity,
salmon, silver, 2174
size and degree of parental care, relation to, 2302
stickleback, threespine, 2469
trout,
brook, 2617
brown, 2124
rainbow, 2124
Feed, dry, mechanical dispenser for, 2387
Feeding,
diurnal rhythm, of goldfish, 2519
green aquatic plants added to food, 2702

Feeding, cont.
habits, yellowtail, 2313
moray eels, role of senses in, 2735
trout,
brook, 2598
brown, 2591
Fern Lake, trace mineral metabolism program, 2659
Fertility,
marine unicellular plankton, 2592
photosynthetic activity of southwest Pacific water masses in relation to its, 2840
Fertilization,
artificial, new techniques, 2295
calcium superphosphate, effects of Scottish lake, 2151
phosphorus fixation affected by, 2135
self, in Serranid fish, 2296
unnatural, effects of sewage discharge, 2432
Fertilizer influence, tilapia-carp mixed culture on, 2350
Fin(s),
adipose in salmonidae, 2613
dorsal of teleosts, 2576
rays in chinook salmon, 2668
regeneration of bony rays, 2137
rot control by terramycin, 2676
spines, albacore, use in age determination, 2399
Fish culture, insects injurious to, 2518
Fisheries,
atomic radiation, effects on, 2478
commercial marine, economic aspects of management of, 2863
Fishery,
Baltic Sea, expansion of active fishing methods needed, 2416
herring, on Puget Sound, 2873
Japanese salmon, 2698
personnel, survey of technical, 2661
Fish finder, effects on fish, 2583
Fish hatchery, feed, dry, mechanical dispensers for, 2387
Fishing,
effects studied with mathematical models, 2205
experimental to determine salmon distribution, 2770
pressure on Des Moines River, 2512
Fish louse (see Argulus)
Fish passage, hydraulic lock, in Netherlands, 2172
Fishway,
capacity, 2768, 2694
darkened, 2692
vertical baffle, 2641
Fission, products and aquatic organisms, 2678
Fixation, phosphorus,
fertilization effects on, 2135
inorganic processes of, 2135
Flatfish habitat preference, experimental study, 2489
Flood, responses of minnows to, 2210
Florida,
Entocythere sp. from Lower Chattahoochee-Flint Basin, 2535
Florida, cont.
Water mass properties of the Straits of, 2636
Flounder, yellowtail, decline of, 2697
Flow,
measurements in small stream, 2835
river, changes in due to hydroelectric diversion, 2893
Flume, survival of migrant salmon passing through, 2874
Fluorescein, toxicity of, 2168
Foaming, detergent pollution, cause and importance, 2430
Food,
conversion for largemouth and smallmouth bass, 2867
diseases of rainbow trout reared on artificial, 2704
Food habits, (see also Life history)
blackfish, Alaskan, 2338
carp, in Utah, 2147
carpsucker, northern river, 2175
coregonids, two compared, 2293
Cynoglossus lingua, 2134
Noctiluca, of, 2559
porpoises, 2479
redside dace in Linesville Creek of, 2750
salmon,
chinook, young of, 2197
chum, young of, 2197
pink, young of, 2197
Sardinella gibbosa, 2132
spawning, King of, 2732
trout,
rainbow, change of as affecting yield, 2664
Forest insect control,
aerial, history, techniques, policy and effects, 2390
fish, effects on, 2392
spraying DDT, effects on fish, 2391
Fork-length, relation to rate-of-catch, 2310
Frequency curve, of the catch, 2615
Fry, chum salmon locomotor performance by, 2744
Fundulus heteroclites, thyroid function in, 2733
Furoxone (see Nitrofuran compounds)
Furunculosis, nitrofuran treatment tests, 2384
Fyke net, modified, for live capture of seaward migrant salmon, 2388

Gadus callarias (see Cod, nematodes)
Gas, swimbladder, inert gas secretion theory, 2221
Gasterosteus aculeatus (see Stickleback, three-spine)
Genetic(s), (see also Hybrids)
artificial induction of functional sex-reversal in genotypic females of the medaka, 2853
population subdivision, effects of, 2529
selection effects, on fish culture, 2667
Genotype, meristic characters determined by environment or, 2345
Geology, continental margin between Brittany and Ireland, 2530
Germo alalunga (see Albacore)
Gill, ventilation in teleosts, 2575
Girdle, pectoral, morphology of, 2225

Gizzard shad,
parasitism by Mazocraeoides olentangiensis, 2648
utilization by game fishes, 2573
Gland(s),
adrenal, of teleosts, 2630
pituitary,
acceleration of spawning by injection, 2567
action of enzymes on gonadotropic activity of extracts of, 2801
temperature changes, effects of on, 2585
thyroid,
function in Fundulus heteroclitus, 2733
Japanese teleosts, 2566
physiology in rainbow trout, 2830
temperature changes, effects of on, 2585
Glycogen, reserves in hatchery rainbow trout, 2653
Goby reproduction, 2575
Goldfish, temperature resistance of, 2743
Gonadotrophic, activity of pituitary extracts, 2801
Gonadotrophin, human chorionic, use of, 2754
Gonads,
maturation, normal following acclimatization, 2408
yellowtail (Seriola quinqueradiata), 2561
Grand Isle, digenetic trematodes of fishes of, 2564
Great Lakes,
abundance of fishes in Quebec, native to, 2601
fishes of the region, 2612
Green River, new Catostomid fish from, 2729
Growth, (see also Life history, Age).
albacore, sex disparity, 2399
bass, largemouth and smallmouth in laboratory, 2867
bluegill, Reelfoot Lake, 2325
carp, 2629
grass, 2354
catfish, flathead, 2227
Catla catla, 2354
day, length has no effect on, 2405
diet, calorie content reduction possible, 2380
differential, not racial in salmon, 2422
excreta, limiting factor on, 2351
interspecific competition effects on, 2293
marking effects on, 2381
Megastomatobus cyprinella, 2354
menhaden, 2537
mullet, striped, 2186
paddlefish, 2666
perch, effects of temperature and density on, 2139
phytoplankton, chemical factors limiting, 2481
rate(s),
analysis of experiments on, 2314
four larval marine fish of, 2329
rearing temperature, influence on, 2815
redside dace, 2750
repressed by direct daylight, 2182
salinity beneficial to, 2369
salmon, sockeye, young of, 2247
Salmonidae, in reservoir, 2923
scale ring implications, 2311
smelt, 2269
snapper, 2639
Growth, cont.
tagging, effects on, 2381
temperature influence on feeding rates, 2248
tilapia mixed with carp, 2140
trout,
brook,
Laurentides Park and Rimouski, 2598
three lakes in Laurentides Park, 2617
brown, 2591
relation between average and individual, 2847
stocked, 2142
unformed scale ring phenomenon, 2311
whitefish, lake, 2368
winter, temperature limiting factor for, 2350
yellowtail, near Japan, 2309
Gulf of Mexico, young scombroid fishes from, 2638
Gulf of Panama, digenetic trematodes of marine fishes from, 2734
Gymnarchus niloticus, object detection by, 2241
Gymnodinium brevis (see Red Tide)
Gymnothorax moringa (see eels, moray)
Gymnothorax vicinus (see eels, moray)

Habitat,
carp, requirements of, 2147
Ontario streams, fauna and, 2371
preference, experimental study of, 2489
Haematology,
blood alteration following hyperactivity, 2273
Hilsa, characters of blood of, 2239
Hanford,
Atomic Products Operation, concentration of radio-isotopes in whitefish near, 2921
biology research, 2691
Hardness, determination using Trilon B, 2425
Harvest,
catfish, channel, minimum angler, 2227
commercial,
sockeye salmon of Rivers Inlet, 2255
-sport compared, 2301
kelp, history of in California, 2891
pound-net relation to spawning run size, 2185
rate,
channel catfish on Des Moines River, 2512
influence of total pressure on, 2143
trout, lake, Cayuga Lake, N. Y., 2363
yellow walleye in Clear Lake, Iowa, 2517
Hatcheries,
trout, of the future, 2859
Hatchery,
contribution of releases to salmon catch, 2879
rainbow trout diet, glycogen reserves and resistance, 2653
Hatching, harmonious in incubation of sturgeon roe, 2712
Hearing, sensitivity relation to swimbladder, 2332
Heart,
electrical stimulation of isolated, 2212
physiology of, 2520
Hematocrit value, for rainbow trout, 2333
Hematology,
arterial oxygen content related to oxygen tension,

Hematology, cont.
2455
comparative study of salmon hemoglobins, 2306
erythrocyte, count and size, trout, 2333
gamma globulin production, role of plasma cells in, 2358
hematocrit value, rainbow trout, 2333
hemoglobins, multiple, in fish, 2307
lactic acid level, in troll caught salmon, 2367
observations, marine teleosts, 2358
volume of blood, rainbow trout, 2333
Hemimysis anomala (see Mysis)
Hemoglobin value, for rainbow trout, 2333
Heptachlor, effects on fisheries, 2515
Herbicide,
Acrolein as a, 2634
farm pond plants and fish, effects on, 2643
toxicity to fish, 2679
water hyacinth control, 2207
Hermaphroditism,
salmon chum, specimen, 2181
Serranid fish, in, 2296
Herring,
distribution, effects of environment on, 2651
egg, 2572
fishery on Puget Sound, 2873
juvenile, relative annual abundance studies, 2257
juvenile stocks, relationship of to adult populations, 2652
migrations in Passamaquoddy region, 2270
Heterogastrinae larvae, morphological characteristics of, 2411
Heteropneustes (see catfish, Indian)
Hexadecanol,
evaporation control, effectiveness for, 2324
standards for use, 2324
Hilsa ilisha (see Perch, climbing)
Hind, red, growth-temperature influence, 2248
Histology,
adrenal gland of teleosts, 2630
thyroid,
albacore, of, 2491
bluefin tuna, of, 2491
tissue, ionic composition of, 2357
trout, rainbow, 2609, 2740
Histopathology, rainbow trout, 2740
History,
forest insect control, 2390
oceanography, development of, 2474
"Homing",
fish populations, of, 2525
salmon, Atlantic, landlocked, 2374
trout, cutthroat, following displacement, 2385
Hormone(s),
estradiol, effect, administered intraperitoneally, 2138
mammalian, chorionic gonadotropine, induced catfish spawning, 2490
sex reversal by induction of, 2215
Husbandry, missing links in fish, 2669
Hybridization,
artificial, salt-water, for reservoir stocking, 2145
Hybridization, cont.
sperm life, effect on, 2123
Hybrids, Mylocheilus caurinum, Ptychocheilus oregonese, 2610
Hydroelectric,
diversion, changes in river's physical characteristics due to, 2893
project effects on salmon, 2503
Hydrogen sulphide, zone, biomass higher than in oxygen zone, 2347
Hyperactivity, lethal to fish, 2273
Hypodermic syringe, microdetermination of dissolved oxygen by, 2914

Ichthyophagous insects, morphology and biology of, 2518
Ichthyosporidium, liver and kidney lesions in rainbow trout, 2471
Ictaluridae, new to Chile, 2496
Ictalurus punctatus (see catfish, channel)
Identification, dolphins (Coryphaena hippurus and C. equiselis), 2746
Illumination,
change of,
affecting behavior of fish school near net, 2813
responses to, 2717
development, early, affected by, 2182
Immunology, method useful in taxonomy, 2493
Incubation, sturgeon roe, 2712
Indian,
Creek, reclamation of, 2767
Ocean, morphometric comparison of yellowfin tuna from, 2857
waters, eggs, larvae and juvenile fish from, 2896
Indicators, bacterial, of pollution, 2910
Insecticide(s),
aerial application,
effects on fish, 2391
history, policy, technique and effects, 2390
carp, effectiveness of on, 2799
chlorinated hydrocarbons, toxicity to fish, 2662
DDT, effects on microflora and microfauna, 2552
dieldrin, effects on fish and wildlife, 2515
dinitrocarbazole, toxicity to fish, 2686
endrin, toxicity of, 2173
heptachlor, effects on fish and wildlife, 2515
isodrin, toxicity-temperature relation, 2166
parathion, effects of on aquatic animals, 2820
phosphorus compounds, toxicity to trout, 2158
Sevin, toxicity compared to DDT, 2492
spraying, aerial, effects on fish, 2392
Tendipes plumonsus, to control, 2805
toxicity to Lebistes, 2165
Insects,
harmful in fish culture, 2518
ichthyophagous, morphology and biology of, 2518
Instrument, portable conductivity bridge, 2657
Introduction(s),
bass, striped, in Spain, 2509
Coregonids, lakes of the Massif Centrale of, 2795
eastern Siberia, fish in of waters of, 2842
Hemimysis anomala, introduced in reservoir, 2409
Invertebrates, estuarine portion of San Francisco Bay,

2528
Investigation(s),
aquatic biological to evaluate self-purification of a stream, 2681
Arctic unit of Fisheries Research Board of Canada, 2881
fish-power problems of, 2889
Ionic, regulation in brown trout, 2715, 2716
Irradiation, of fish, tap water-heavy water effect variation, 2457
Isodrin, toxicity-temperature relation, 2166
Istiompax brevirostris (see Marlin, black)
Istiophorus orientalis (see Sailfish)

Japan,
comment and bibliography on the medaka (Oryzias latipes), 2655
studies on marine biology in, 2724
Japanese, salmon fishery, 2698
Jumna River, plankton and physico-chemical conditions of, 2895
"Jumping", behavior of anchovy shoals, 2836
Juveniles, fishes from Indian waters of, 2896

Kansas, fishes of,
Big Blue River Basin, 2645
Chautauqua, Cowley, and Elk Counties, 2644
Katsuwonus pelamis (see Tuna, skipjack)
Kelp, harvesting, history of in California, 2891
Key, Tilapia to,in ponds, 2739
Kidney,
disease, experimental infection methods, 2394
plasma cells absent, 2358
tests for control of disease in trout, 2866
Kogoshima Bay, plankton diatoms, 2557
Kyoto University, publications 1947-1957, 2800
Kyushu, water temperature and chlorinity of upper layer in seas off, 2725

Laboratory,
animal, the medaka (Oryzias latipes), 2706
behavior study, facilities described, 2397
facilities at U. S. research, 2379
Lactate, changes in of Salmo gairdneri blood, 2880
Lactic acid,
blood accumulation of, following hyperactivity, 2273
death strongly associated with, 2367
Ladder, salmon on Tuloma River, 2706
Laguna Madre, preliminary biological studies on, 2819
Lake(s),
air and surface water temperatures, relations between, 2778
Balaton, organic sedimentation in erosion-littoral of, 2794
Cayuga, life history of sea lamprey of, 2766
dredging, ecological effects on, 2485
Hamilton, Arkansas, reclamation of, 2672
Huron,
currents and water masses of, 2683
mechanism for mixing waters of, 2777
population fluctuations of yellow perch in Saginaw Bay, 2760
Lake(s), cont.
Massif Centrale of, acclimitization of Coregonids in, 2795
Mendota, circulation over Second Point Bar, 2538
Neuchatel, taxonomic study of Coregonus, 2635
stratified, effects of artificial currents, 2407
Superior, limnological data of, 2771
Lamprey,
river, spawning of, 2605
Sea, life history of in Cayuga Lake, 2766
Larvae,
Atka mackerel (Plèurogrammus monopterygius), 2577
bonefish (Albula vulpes), 2611
chaoborus, limnetic distribution of, 2482
growth rate of four marine fish, 2329
post-, broadbill swordfish, described, 2352
Larval,
fishes from Indian waters, 2896
sand sole, development of, 2875
Lateral-line,
directional audibility through, 2831
functions of and habits of fish, relation between, 2569
hearing sensitivity related to, 2332
Laurentides Park, brook trout,
fecundity and growth, 2617
growth and feeding, 2598
Laws, commercial fisheries of Alaska, 2375
Leiostomus zanthurus (see Spot)
Length, relation to,
mesh size of nets, 2846
weight of yellowfin tuna, 2722
Lepomis macrochirus (see Bluegill)
Lernaea cyprinaeca, parasite of fish, 2868
Life history,
Apatemon gracilis pellucidus, 2862
bluegill, in West Okoboji Lake, 2599
brook stickleback, 2929
Cynoglossus lingua, 2134
Dioptomus ashlandi, seasonal life cycle, 2330
great barracuda, 2647
menhaden, 2537
mullet, striped, 2186
perch, yellow, 2376
pilchard, South African, 2245
runner, blue, early development of, 2201
Scorpaenidae of California, resume of, 2497
sea lamprey in Cayuga Lake, 2766
spot, 2580
stickleback, threespine, Alaska, 2693
trematode, Phyllodistomum simile, 2243
walleye, yellow, 2377
whiting, Indian sand, 2510
Ligament, dorsal aorta in of certain fishes, 2747
Light,
behavior and reactions of Pacific sardine, 2658
distribution of some inshore copepods, effects of on, 2637
feeding rhythm, influence on, 2519
intensity, relation to plankton photosynthesis, 2402
maturation of adult blueback salmon, effects

Light, cont.
of on, 2671
quality and quantity, no effect on growth and maturation, 2405
spawning stimulation for northern pike, 2291
Ligula Intestinalis,
carp infested by, in Russian reservoir, 2415
shiner, common, infested with larvae of, 2472
Lilla Lule Alv, biology of juvenile salmon in, 2590
Limanda ferruginea (see Flounder, yellowtail)
Lime, bog lake transparency increased by addition of, 2250
Limnology, (see also Oceanography)
air and surface water temperatures in lakes, relation between, 2778
"apatotrophic", new term, 2488
Arctic lakes of in relation to water supply, 2911
Ca, Mg, pH, and alkalinity determination, quick, of, in one sample, 2424
Canyon Ferry Reservoir, Mont, 2277, 2776
chemistry, relation of invertebrates to, 2154
circulation, artificially induced in lakes, 2407
current, surface, studies of, 2194
fertilization of Scottish lake, 2151
Finnish lakes, 2549, 2550
habitat classification of streams, 2514
hardness determination using Trilon B, 2425
interrelations of selected chemical and physical factors, 2459
Lake Balaton, organic sediment in erosion-littoral of, 2794
lake classification by standing crop of bacteria in sediments, 2781
Lake Huron of, 2777
Lake Mendota, 2538
lake's morphometry, effect on primary production, 2282
Lake Superior of, 2771
lime treatment, effects of, 2250
oxygen,
content, daily variation of, 2486
determination electrochemically, 2426
phosphorus, origin and distribution in Lake Erie, 2328
photosynthesis characteristics of phytoplankton, 2483
physico-chemical and bottom fauna, Chaplin's Lake, La., 2487
plankton,
development in new ponds, 2417
phyto-, cycles in lake, 2330
radiophosphorus metabolism in lakes, 2322
seasonal growth and succession of plankton algae, 2283
sedimenting planktonic debris, chemical characteristics of water and sediments and benthonic populations, correlation between, 2888
South Bay, Manitoba, 2777
thermocline, naturally occurring visible, 2356
Lindane, Argulus control with, 2298
Loach,
reproduction, 2587
spawning, 2567
Locomotion, chum salmon fry, 2744
Long-line, yellow-fin tuna school deduced from catch by, 2797
Louisiana, fish populations of backwater lakes of, 2660
Lysergic acid, chromatic response of Fundulus to, 2458

Mackerel,
Atka, larvae and young in the North Pacific, 2577
feeding habits compared to yellowtail, 2313
king, comparative osteology of, 2359
painted, comparative osteology of, 2359
Spanish, comparative osteology of, 2359
Madison River, fishery management studies on, 2774
Magnesium,
blood, measured in migrating salmon, 2464
determination in same sample with pH, Ca, and alkalinity, 2424
Maintenance, living aquatic animals of, 2883
Makaira herschelii (see Marlin, blue)
Makaira mitsukurii (see Marlin, striped)
Malachite green,
bacteriostatic power of, 2623
prophylaxis for, 2389
Manage(ment),
Alaska fisheries, progress report, 2852
Atlantic coastal fishery resources, can we? 2864
commercial marine fisheries, aspects of, 2863
doctoral dissertations on, 2696
Lake Victoria, reusing bottom mud, 2164
laws and regulations,
commercial,
Alaska, 2375
perch, yellow, 2376
walleye, yellow, 2377
Madison River system, fishery, 2774
quota control,
economic aspects of, 2287
sociological effects of, 2286
salmon, to increase stocks, 2709
Woods Reservoir, fishery, 2731
Marine biology, basic studies on in Japan, 2724
Marking and tagging,
chinook salmon fingerlings, predation on, 2878
fin clipping, regeneration in chinook salmon, 2178
fin regeneration, 2137
random recapture following, 2303
recoveries, angler, landlocked Atlantic salmon, 2374
recovery rates, using hydrostatic tags, 2505
retention and effects on growth and survival, 2381
shad, American, in Quebec, 2461
strap tags on channel catfish, 2209
tag pins, corrosion resistance of, 2191
Marlin,
black,
seasonal variation of swimming layers of, 2826

Marlin,
black, cont.
synonymies and diagnoses of, 2360
blue, synonymies and diagnoses of, 2360
morphology of pectoral girdle of Makaira, 2225
striped, races of, in Pacific, 2226
Mass(es), water,
distribution and movement of in western North Pacific, 2843
Lake Huron, 2683
photosynthetic activity of in southwest Pacific, 2840
Straits of Florida, 2636
Massachusetts, three reclaimed trout ponds in, 2755
Massif Centrale, Coregonids of lakes of, 2795
Maturation,
adult blueback salmon, 2671
day length, no effect on, 2405
normal, after transplantation to warmer climate, 2408
Maturity,
albacore, 2398
precocious salmon, male, use in propagation, 2237
yellowtail, in Japanese waters, 2508, 2561
Mazocraeoides olentangiensis, morphology and development, 2648
MCPA, toxicity to fish, man, and livestock, 2427
Measurement, respiration rate, of phytoplankton, 2348
Measuring,
current, fishermen's device, 2834
dissolved oxygen, small concentrations of, 2926
flow in small stream, 2835
Medaka,
artificial induction of functional sex-reversal in genotypic females of, 2853
comment and bibliography, 2655
Megastomatobus cyprinella, growth of, 2354
Melanophores, effect of lysergic acid on, 2458
Membrane, egg, hardening enzyme in salmon, 2412
Menhaden, length, weight and age of catch, 2537
Mesh, size in nets in relation to fish length, 2846
Metabolism,
anaerobic, theory of, 2238
bluegill, seasonal change in, 2539
intermediary, knowledge reviewed, 2396
oxygen,
BOD, CO_2, redox potential, and pH comparison, 2486
consumption at steady activity rate, 2372
phosphate radioactive, in lakes, 2322
respiratory, influence of temperature on, 2855
trace mineral at Fern Lake, 2659
Metamorphosis,
bonefish, 2611
ten-pounder of, 2765
Meter, resistivity, management uses, 2395
Method(s),
age determination based on vertebrae centra, 2309
analysis, plankton, in turbid water, 2149
analytical, in stream studies, 2442
Method(s), cont.
bio-assay, development of, for pulp pollution control, 2449
controlling aquatic weeds in fish ponds, 2682
determination,
ammonia and organic nitrogen, 2216
microtonometric of CO_2, N, and O_2, 2340
oxygen, dropping mercury electrode, 2452
pH, Ca, Mg, and alkalinity, 2424
stream re-aeration coefficient, 2437
equation for oxygen balance estimation, 2443
estimation, of plankton algae numbers, 2443
evaluating self-purification of a stream, 2681
immunological, for taxonomy, 2493
infection, experimental, of kidney disease, 2394
jar culture of trout eggs, 2383
measurement of density, by suspended plummet method, 2501
mortality estimation, natural and fishing, 2276
oxygen,
consumption of salmonids, study, 2153
dissolved,
determination of, 2900, 2925
electrochemical, 2902, 2903
fish pond water in, 2792
hypodermic syringe by, 2914
measuring and recording, 2926
symposium on, 2913
fish blood in, micro-gastronomic, 2850
uptake, light and dark bottle, 2783
pH determination, 2155
photosynthetic activity, water masses of by C^{14}, 2840
population estimation, described, 2152
purification capacity, increase in stream by turbine aeration, 2905
removal of chlorine from tap water, 2477
respiration rate measurement, of phytoplankton, 2348
sampling, pollution, cross sectional, 2220
Microbiology, in Black Sea, 2347
Microdetermination, dissolved oxygen of, 2914
Micro-organisms, a new class of, 2633
Micropogon undulatus (see Croaker, Atlantic, 2301
Micropterus dolomieui (see Bass, smallmouth)
Micropterus salmoides (see Bass, largemouth)
Microscope, inverted method of estimating algae numbers, 2456
Microspordian, new parasite, 2869
Midgefly, resistant to electroplating wastes, 2865
Migrant, survival of downstream salmon, 2874
Migration(s), (see also Movements)
albacore, northwestern Pacific, 2825
croaker, Atlantic, 2301
herring, Passamaquoddy region, 2270
pattern, study of landlocked salmon, 2374
rates, determined by tagging, 2505
salmon,
blueback, Wenatchee River, 2722
chinook,
Columbia River, 2877
Wenatchee River, 2722
humpback, in Sakhalin Region, 2703
offshore waters in, 2790

Migrations,
salmon, cont.,
Pacific, dark adaptation prior to, 2253
pink, retinal responses associated with, 2741
sockeye, biochemical studies during spawning, 2882
spawning, biochemical studies, 2373
shad, American, along Atlantic coast, 2184
swordfish, northwestern Pacific, 2848
vertical, plankton producing red tide, 2786
yellowtail, in East China Sea, 2308
Milt, pH value of in trout, 2824
Mineral(s),
trace, metabolism program at Fern Lake, 2659
trout nutrition and physiology, role of in, 2870
Misgurnus anguillicaudatus (see Loach)
Model(s),
estuary, for predicting effluent effects, 2218
mathematical, fishing effects study with, 2205
numerical, used in study of yields, 2260
Mold, pathogenetic water, 2803, 2804
Monuran,
toxicity to fish, man, and livestock, 2427
vegetation control, 2427
Morphology,
adipose fin in salmonidae, 2613
blood of Hilsa, 2239
dorsal fin of teleosts, 2576
Mazocraeoides olentangiensis, 2648
pectoral girdle of Makaira, 2225
skipjack, central and eastern tropical Pacific, 2728
tuna,
pineal organ of, 2806
yellowfin, eastern tropical Pacific, 2723
Morphometry,
production, primary, affected by, 2282
tuna, yellowfin,
equatorial Pacific, 2807
Indian Ocean, 2857
southwestern Great Sundra Islands and Pacific, 2808
Mortality,
electro-fishing, effect of salt added to stream, 2289
estimates, errors in, 2365
estimation of natural, and fishing, 2276
exploitation of aquatic resource, 2581
fishing,
lake trout of, 2363
mathematical model, effect studied with, 2205
mass, grey weakfish eggs, storm caused, 2249
natural, of cutthroat trout, 2385
post-planting, early, various factors evaluated, 2171
quantitative comparison of rates, 2315
rate, muscular fatigue relation to, 2367
red tide, West Africa and Smyrna, 2163
salmon,
chinook, Columbia River spring, 2877
Pacific, troll-caught, 2883
walleye, yellow, 2517
Movement(s), (see also Migration)
colored net, fish through, 2810
daily, relation to water temperature, 2128
fishway capacity, 2768
"homing"
sunfishes, of displaced, 2303
trout, following displacement, 2385
salmon, through fishway, 2692
sauger, in river, 2211
trout, brook between salt and fresh water, 2271
underwater fencing net,
effect on colored, 2621, 2627
effect on inclined, 2622
effect on mesh size of, 2626
effect on, white vinyl tube, 2628
water masses, 2843
Moxostoma atripinna, a new Catastomid from Green River, Kentucky and Tennessee, 2729
Mugil cephalus (see Mullet, striped)
Mullet,
certain reproductive tissues of, 2738
striped, life history, 2186
Multiple-use, reservoir practices in U. S., 2665
Muscles, motor, nerve endings of, 2213
Muscular fatigue, mortality rate related to, 2367
Muskellunge,
pond culture of, 2624
Tennessee streams in, 2871
Mylocheilus caurinum X Ptychocheilus oregonese,
osteology of, 2610
Mysis,
introduced and established in reservoir, 2409
new for Dnepr system, 2749

Nannoplankton, chamber for counting, 2327
Nanseishoto, water temperature and chlorinity of upper layer of seas around, 2725
Naphthenic acid, toxicity related to oxygen, 2445
Narcotics, toxicity to fish, 2167
Narragansett Bay, physical oceanography of, 2782
Neothunnus (see tuna, yellowfin)
Nerve endings, motor, of muscles of fins, 2213
Net(s),
block-off, fish population samples for, 2759
colored,
behavior of fish near, 2811
change of illumination, effect on fish behavior, 2813
depth of color, effect on fish behavior, 2812
drive fish to, 2621, 2627, 2814
passage of fish through, 2810
commercial, selectivity and effectiveness, 2860
copper naphthenate for preserving, 2726
depth of, by depth-finder, 2614
fyke, modified for live capture of seaward migrant salmon, 2388
inclined, to drive fish, 2622
life, relation between mesh size and fish length, 2846
mesh size of, to drive fish, 2626
plankton, discussed, 2499
seine, factors affecting catch in, 2600
trap(s),
behavior of fish entering, 2589

Net(s)
trap(s), cont.
bluegill sunfish for, 2758
selectivity in estimating fish populations, 2542
white vinyl tube, to drive fish, 2628
Netherlands, fish species on verge of extinction in, 2828
Neurosecretory tract, modification during life history, 2466
New Zealand, snapper, racial differences, 2639
Niemen River, chemical composition and bacteriological contamination of, 2619
Nitrofuran compounds, furunculosis treatment tests, 2384
Nitrogen,
fractions, changes in salmon muscle, 2463
microtonometric determination of, 2340
organic, determination in sea water, 2216
Nitrogenous, non-protein, muscle constituents, 2465
Noctiluca sp., occurrence and feeding habits of, 2559
Nomenclature, dual authorship, Cuvier and Valenciennes not correct, 2131
Nomograph, determination of dissolved oxygen, 2452
North Pacific, age and race of red salmon in, 2578
North Twin Lake, utilization of gizzard shad by game fish in, 2573
Notropis
cornutus (see Shiner, common)
dorsalis (see Shiner, bigmouth)
uranoscopus, taxonomic description of, 2304
Nutria, vegetation control in reservoirs, 2480
Nutrition,
minerals, role of in trout, 2870
missing links in fish husbandry, 2669
salmonidae in reservoir, 2923
tilapia mixed with carp, 2140

Observation,
trout fingerlings, estimation of survival rate by, 2849
under chamber, 2756
Oceanography (see also Limnology)
atomic radiation effects on, 2478
biomass higher in H_2S than O_2 zone, 2347
Canadian Arctic, 2884
Castillon Harbour, climatic and thermic data, 2839
chemical data, Gulf of Mexico, 2403
chemistry,
Atlantic waters of Canada, of, 2364
sea of, symposium on, 2217
currents,
drift bottle recoveries, 2263
surface, Gulf of Maine, 2183
daylight penetration measurements, 2355
deep water structure, Laurentian Channel, 2268
density measurement, by suspended plummet method, 2501
Eastern Tropical Pacific, cruise observations, 2189
Oceanography, cont.
electricity of the oceans, 2233
element of dominant flow, westerly, 2265
estuary, total biomass seasonal variation in, 2133
historical note of development of, 2474
history of, 2217
instrument, hot wire, for turbulence measuring, 2280
Kamchatka, USSR, drift bottle surveys off, 2789
Kyushu and Nanseishoto, water temperature and salinity in upper layer of seas, 2725
Laguna Madre de Tamaulipas, biological studies, 2819
measurements, drogue and GEK, in deep water, 2278
nannoplankton, counting chamber for, 2327
Narragansett Bay, 2782
Noctiluca, occurrence and feeding habits, 2559
observations of east coast of U. S., 2695
particulate matter, vertical distribution of, 2346
physical an d chemical properties of sea water, 2924
plankton,
collection from Gulf of Mexico, 2393
new species in Black and Azov Seas, 2414
photosynthesis relation to light intensity, 2402
vertical migration of, 2786
salinity-particulate matter distribution relation, 2346
Sheepscot River estuary, 2773
standing crop of reef fishes, 2326
surface drift charts, eastern tropical Pacific Ocean, 2305
surface temperature measured from aircraft, 2502
survey of south Atlantic Coast of U. S., 2288
temperature(s),
chlorinity and depth recorder, 2689
seasonal surface, variations in, 2234
thermocline topography and "ridging" relation, 2121
topography, geopotential, drift bottle agrees with, 2254
upwelling, Gulf of Panama, aspects of, 2122
Vellar estuary, organic matter of plankton, 2842
water(s),
Bering Sea and Aleutian region of, 2144
exchange, oxygen and hydrogen sulphide zones, indicator for, 2347
mass properties, 2636
western North Pacific,
water(s) masses, distribution and movement in, 2843
wind, influence on surface circulation, 2183
Offshore, fishes of California, 2856
Oil wells, tolerance of fish to brine water of, 2524
Oithona nauplius, swimming and feeding of, 2335
Okhotsk River, salmon, increasing stock in, 2709
Olfactory,
organ, development of, 2214

Olfactory, cont.
responses of fish to stimuli, 2717
Oncorhynchus,
fatigue and mortality in troll-caught, 2883
gorbuscha (see Salmon, pink)
keta (see Salmon, chum)
kisutch (see Salmon, silver)
nerka (see Salmon, sockeye, blueback)
origin and speciation, 2604
tschawytscha (see Salmon, chinook)
Operations, hatchery, cost of salmon in Washington's, 2879
Opercular bones, age determination, use of, 2399
Opsanus sp., new toadfish from Bimini, 2737
Oregon, rotary fish screens in, 2670
Organ, pineal, tuna (Thunnus thunnus) of, 2806
Organic matter, plankton, C^{14} for study of, 2845
Organic matter, plankton, influence of on, 2793
Oryzias latipes (see Medaka)
Osmerus mordax (see Smelt)
Osmoregulation,
Arctic fish in, 2832
Scottish brown trout in, 2716
Osteology,
chondrocranium of catfish, 2470
comparative, Scomberomorus of Florida, 2359
cyprinid hybrid, of, 2610
Ostracods, Entocythere, from Lower Chattahoochee-Flint Basin, Florida, 2535
Otoliths, formation of annual rings in, 2562
Ovaries, development of albacore, 2398
Oxidation, study of, in Thames Estuary, 2439
Oxygen,
anomalies near Coos Bay, Oregon, 2523
automatic potentiometric titration in determination of dissolved, 2688
balance,
bottom fauna, effects on, in polluted streams, 2447
equation for estimating stream, 2443
sludge deposit, effects on, 2438
thermal "pollution" effects, 2428
vegetation effects on, in polluted streams, 2447
chemical's toxicity affected by, 2445
consumed, over sediment cores, 2780
consumption,
O_2 and CO_2 concentrations, relation to, 2372
salmon, method of study of, 2153
content,
apparatus for recording, 2684
no influence on carp spawning, 2511
daily variations in water content, 2486
depletion in littoral zone, 2596
determination, electrochemical, 2426
dissolved,
determination of, 2900, 2925, 2452
electrical recorder for, 2901
electro-chemical measurement of, 2902, 2903
measuring and recording small concentrations, 2926
method, simplified, of computation, 2436
microdetermination of, 2914
Oxygen,
dissolved, cont.
poloragraphic determination of, 2928
ponds, comparison of methods of determination of, 2792
portable analyser for determination of, 2792
requirements for fish, 2435
sag curve, relation to, 2436
symposium on determination of, 2913
distribution influenced by bacteria, 2551
egg utilization independent of CO_2 level, 2251
electrochemical determination, 2607
fish blood in, micro-gasometric determination of, 2850
impoundment effects on, in streams, 2441
measuring by an electrode system, 2687
microtonometric determination of, 2340
polarographic electrode, 2540
pump for increasing pondwater content, 2141
reduced content of, ability of fish to swim in, 2861
relationships, in streams, 2822
solubility and percentage saturation of, 2904
surface reaeration, 2556
tension,
CO_2 in blood, relation to, 2455
minimum, for carp, 2238
O_2 in arterial blood, relation to, 2455
uptake, light and dark bottle method, 2783
Oxygenation, used to trap northern pike in "freeze-out" lakes, 2179

Pacific,
central and eastern tropical, skipjack of, 2728
eastern tropical,
yellowfin tuna of, 2723
yellow tuna and skipjack tuna of, 2722
equatorial, yellowfin tuna of, 2807
Great Sundra Islands and, yellowfin tuna of, 2808
Paddlefish, growth and reproduction, 2666
Parasite(s)
Apatemon gracilis, life cycle of, 2862
Argulus, control with Lindane, 2298
Bothriocephalus sp. in bluegill, 2125
cestode, new genus and species, 2318
Corynosoma, juvenile, in Pacific salmon, 2259
Diphyllobothrium latum, of Baltic Sea fish, 2206
fish of the lower Dnepr River, Russia, 2418
helminths of carp, mullet, lake trout in Russia, 2415
Lernian, freshwater fish of, 2868
Ligula intestinalis, larvae in common shiners, 2472
new microsporidan, 2869
monogenea, of Indian freshwater fish, 2320
ostracods of the genus Entocythere, 2535
Phyllodistomum simile, life history, ecology, structure, 2243
Sardinella gibbosa of, 2132
strigeidae, cercaria migration in fish host, 2319
tetraonchinae, new genus of, 2320
trematodes,
digenetic, marine fish of, 2734
fishes of Grand Isle, Louisiana, 2564

Parasite(s)
trematodes, cont.
Mazocraeoides olentangiensis, 2648
Parathion,
aquatic animals, effect on, 2820
toxicity to trout, 2158
Parental care, fecundity relation to, 2302
Parthenogenesis, pathological, phycomycete infection caused, 2223
Pathogenetic, water mold, 2803, 2804
Paul Lake,
predator-prey, rainbow trout and redside minnow,
distribution and movements, 2649
interaction, 2650
rainbow trout yield, 2664
Pentachlorophenate sodium, factors affecting toxicity of, 2331
Perca flavescens (see perch, yellow)
Perca fluviatilis (see Perch)
Perch,
climbing, characters of blood of, 2239
growth, temperature and density effects on, 2139
nerve endings, of fin muscles, 2213
swimbladder, acoustic reflection of, 2240
tolerance to salt water, 2159
yellow,
ecology, 2376
eurythermal as roach, 2342
fluctuations in population of in Saginaw Bay, 2760
life history, 2376
management, 2376
recorded in Florida, 2299
Percidae, reproductive behavior and ecology of 14 species of darters, 2890
Petromyzon fluviatilis (see Lamprey, River)
Petromyzon marinas (see Lamprey, Sea
pH,
-alkalinity, 2899
blood, yearling Kamloops trout, changes of in, 2880
bottom fauna, influence of, 2129
determination,
Ca, Mg, and alkalinity in same sample, with, 2424
carp spawning, relation to, 2343
methods, 2155
pentachlorophenate toxicity affected by, 2331
eggs, milt, coelomic fluid of, in trout, 2824
toxicity of chemical wastes related to, 2169
Phenolic waste water, effect on fish, 2919
Philometra sanguinea, on carp of lower Dnepr River, Russia, 2418
Phoenix Islands, postlarval form of skipjack of, 2603
Phosdrin, toxicity to trout, 2158
Phosphate,
metabolism, in lakes, 2322
phosphorus, correlation to turbidity, 2328
Phosphorus,
fixation,
fertilization, affected by, 2135
Phosphorus
fixation, cont.,
inorganic processes of, 2136
origin and distribution in Lake Erie, 2328
serum, effect of estradiol on, 2138
zooplankton, content of, 2887
Photoperiods, controlled, temperature resistance of goldfish maintained under, 2743
Photosynthesis, light intensity, dependence of phytoplankton on, 2402
Photosynthetic,
diatoms, freshwater, characteristics in relation to underwater radiation, 2912
water masses, activity measured by C^{14} method, 2840
Phycomycete, parthenogenesis, pathological infection of, 2223
Physical,
Jumna River conditions, 2895
oceanographic observations, Canadian Arctic, 2884
sea water properties, conference on, 2924
Physiology,
blood,
following hyperactivity, 2273
Hilsa, of, 2239
heart and its extrinsic innervation, 2520
lateral line analyzers, 2242
muscle nitrogen fractions, changes in, 2463
swimbladder relation to hearing, 2332
thyroid,
biological function of, 2405
rainbow trout, aspects of in, 2830
trout, minerals, role of, in, 2870
Pike,
breeding, artificial, 2705
Diphyllobothrium latum in, 2206
nerve endings, of fin muscles, 2213
northern,
electrical stimulation of heart, 2212
rescue from "freeze-out" lakes, 2179
spawning behavior of, 2291
sperm, storage and transportation, 2713
Pilchard, South African, life history of, 2245
Pilodictis olivaris (see catfish, flathead)
Pituitary gland,
action of enzymes on gonadotrophic activity of extracts of in Indian catfish, 2801
injection of to accelerate spawning of loach, 2567
-thyroid relationship with temperature changes, 2584
Plankton, (see also Limnology, Oceanography)
algae, method and basis for number estimation, 2456
analysis of, in turbid water, 2149
biochemical composition of, 2401
Chaoborus, limnetic distribution of, 2482
collection from Gulf of Mexico, 2392
Crustacea, annual cycles, dualism supported, 2292
debris, correlation with chemical characteristics of water and sediments and benthonic populations, 2888

Plankton, cont.
development in new ponds, 2417
diatoms in Kogoshima Bay, 2557
distribution, spatial, apparatus for study of, 2500
estuary, organic matter content variation, 2133
Euphausiidae at southwest Sakhalin Coast, 2708
horizontal hauls, effect on horizontal distribution of, 2547
Jumna River, quantitative study, 2895
lime treatment, influence on, 2250
marine fertility, controlled by, 2592
nets, a discussion of, 2499
nature and abundance of, influence of organic matter on , 2793
Noctiluca, effects on, 2559
North Twin Lake of, Iowa, 2219
phosphorus content of, 2887
photosynthetic characteristics related to underwater radiation, 2912
phyto-,
classification of communities, 2555
cycles in Lake Washington, 2330
fertilization, effect of on, 2151
growth limiting factors, chemical, 2481
northwest Pacific Ocean, of, 2235
photosynthesis,
characteristics of, 2483
dependency on light, 2402
pollution, effect of on, 2448
respiration rate, measurement with carbon-14, 2348
seasonal growth and succession in a reservoir, 2283
standing crop, Canyon Ferry Reservoir, 2776
zoo, relationships, in a reservoir, 2277
population, Diaptomus ashlandi, development of, 2330
predators, trout for insect substitution, effects on, 2250
radioactive cerium-144, uptake, accumulation and loss of by algae, 2779
red tide producing, vertical migration of, 2786
species, new, in Black and Azov Seas, 2414
toxaphene toxicity to, 2200
waste disposal, deep sea, effects on, 2432
zoo-,
Canadian Arctic, observations in, 2884
estuaries, composition and distribution of, in, 2420
paucity in inner Bay of Fundy, 2267
Plants (see Aquatic(s), Trees, Vegetation)
Plasma,
cholesterol, changes in, migrating salmon, 2464
volume, rainbow trout, 2333
Plasma 17-hydroxycorticosteroids, changes in of Pacific salmon and rainbow trout, 2751
Plecoglossus altivilis, 2817, 2818
Pleurogrammus monopterygius (see Mackerel, Atka)
PMA, tolerance of channel catfish to, 2170
Poland, river waters, chemical composition of, 2620
Polarographic, dissolved oxygen determination, 2928
Policy, forest insect control, 2390
Pollution,
abatement program, use of stream data in, 2434
apparatus for recording oxygen content, 2684
bacterial indicators of, 2910
bacteriological, Niemen River, 2619
bio-assay method of evaluation, 2606
biochemical degradation products, 2595
biological effects of, 2446
biological problems in water, 2690
biological tests for protection against, 2922
chemical wastes, synergistic constituents at low pH, 2169
cooperative, State-Industry studies, 2220
detergents, foaming, independent of stream content, 2430
disinfectants, effects on fish and animals, 2917
electroplating wastes, midgefly resistant to, 2865
estuarine,
fauna, effects on, 2448
water quality patterns by same-slack technique, 2484
explosives factory, waste toxicity, 2168
fertilization, effects of sewage discharge, 2432
insecticides
by, 2686
phosphorus, toxicity to trout, 2158
lignite pit discharge, complete fill kill, 2378
marine, diving studies of effluents, 2450
midwestern stream, effects of on, 2907
oil field brine, euryhaline species tolerance to, 2504
oil refinery and activated sludge, 2553
organic, biological evaluation of, 2597
organisms, effects on polluted streams, 2447
oxygen,
dissolved, requirements of fish, 2435
sag curve related to dissolved oxygen, 2436
phenolic waste, effects on fish, 2919
poisoned waters, 2685
predicting effects of wastes on receiving waters, 2218
prediction of fish tolerance to, 2272
pulp mill, bioassay methods for control of, 2449
radioactive, biological deactivation of water, 2453
reaeration,
factors affecting, 2439
theory for coefficient determination, 2437
refinery wastes, toxicity of 86 chemicals of, 2462
review of literature, 2400
rodenticide, toxicity of, 2168
Ruhr River, destruction of fish, 2906
sampling, cross-sectional, streams, 2220
self-purification,
method of evaluating, 2681
Sola River, 2618
Wisconsin streams, 2554
slime-controlling agents, 2157
sludge deposits, effect on oxygen balance, 2438

Pollution, cont.,
strontium-90 concentrations permissible in reservoirs, 2454
sulfide mine wastes, 2821
synthetic detergents and soaps, toxicity to fish of, 2916
thermal, effects on oxygen balance, 2428
treatment plant design, use of stream data in, 2443
uranium ore refinery, effects of, 2429
waste(s),
disposal, deep sea, 2432
mixing and diffusion of, 2440
Polydon spatula (see paddlefish)
Pond(s)
acid strip mine, ecological study of, 2406
aquatic weed control in fish, 2682
balance, relation of physical, chemical, biological factors to, 2460
bluegill sunfish, trapping in, 2758
culture of muskellunge in Wisconsin, 2624
dissolved oxygen in, methods to determine, 2792
productivity, relation of chemical, physical and biological factors, 2460
reclaimed trout, in Massachusetts, 2755
tilapia, key to in, 2739
zoobenthos of, 2419
Population(s),
Arripis trutta, in Australia, 2775
backwater lakes fish in Louisiana, 2660
bacteria, in sea water, 2536
block-off net to sample fish, 2759
brown trout, 2847
density,
perch growth, effects on, 2139
young salmon in multi-basin system, 2258
estimating fish, significance of trap-net selectivity, 2542
estimation,
methods described, 2152
walleye, yellow, in Clear Lake, Iowa, 2517
Euphasiidae, at southwest Sakhalin Coast, 2708
failure of survival of slowly growing members of, 2837
flounder, yellowtail, decline of, 2697
genetical effects of subdivision, 2529
harvest influence on spawning size of, 2185
juveniles, relative annual abundance of, 2257
loach, influence of on productivity of pond, 2587
Plecoglossus altivelis, density of, 2817
production related to spawning stock size, 2261
sampling,
methods for abundance measurement, 2247
quantitative, electric seine for, 2203
Silesian Vistula trout spawners, 2809
trout, condition evaluated, 2143
yellow perch, fluctuations in, 2760
yield-environment-stock relation studied, 2260
Porpoises, food of, 2479
Postlarval, skipjack (Katsuwonus pelamis) from Phoenix Islands, 2603
Potassium cyanide, toxicity related to oxygen, 2445
Potomac-Shenandoah, game fish streams and records of fishes from, 2646
Power, fish problems, 2889
Predation,
gizzard shad by game fishes in north Twin Lake, Iowa, 2573
marked chinook salmon fingerlings, 2878
redside shiner by rainbow trout in Paul Lake, B. C., 2649, 2650
Predators, plankton, effect of trout for insect substitution, 2250
Preservative, copper naphthenate for nets, 2726
Pressure,
electrical conductivity of sea water, effect of on, 2838
oceanographic reversing thermometer, effect of on, 2533
Production,
bottom fauna, Provo River, Utah in, 2791
environmental factors affecting salmon, 2264
primary, of high latitude lakes, 2282
Productivity,
bioassay, bacterial, possible use in studies, 2189
chemical, physical, and biological factors, relation of, 2460
marine, symposium on, 2208
mountain river of, 2784
organic, $CaCO_3$ in ocean, 2841
Propagation,
flathead catfish (Pilodictis olivaris), 2673
jar culture of trout eggs, 2383
Protein,
amino acid, variation in composition during development of growth of young rainbow trout, 2632
content, changes during spawning migration, 2373
diet content reduction possible, 2380
plankton content, 2401
rainbow trout eggs, changes in amino acid composition, 2802
serum, effect of estradiol on, 2138
Proteocephalus neglectus, lake trout infested by, in Russian lake, 2415
Provo River, Utah, bottom fauna production, 2791
Prymnesium parvum, toxin poisonous to fish in cultures of, 2680
Psettichthys melanostictus (see Sole, sand)
Pseudomonas ecology of some types, 2451
Ptychocheilus oregonese (see Squawfish)
Publications, U. S. Bureau of Fisheries of, 2190
Puget Sound, herring fishery on, 2873
Pulsatory direct current, electric fishing with, 2640
Purification, self, method of evaluation of stream, 2681
Pyrethrum, toxicity to Lebistes, 2165

Quota control,
economic aspects of, 2287
sociological effects of, 2286

Race(s),
anadromous fishes, summer and winter, 2886
marlin, striped, of Pacific, 2226

Race(s), cont.
salmon, red in North Pacific Ocean, 2578
snapper, New Zealand, differences in size and growth, 2639
Radiation,
atomic, effects on oceanography and fisheries, 2478
photosynthetic characteristics of diatoms in relation to underwater, 2912
Radioactive,
C^{14},
organic matter cycle, study by, 2845
organic productivity and solubility product of $CaCO_3$, study by, 2841
photosynthetic activity of water masses, measurement by, 2840
carbon, used in plankton photosynthesis tests, 2402
Cerium-144, uptake, accumulation and loss by marine algae, 2779
isotopes, concentration of in Columbia River whitefish, 2921
phosphorus, metabolism, in lakes, 2322
pollution, effects on stream, 2429
waste disposal, danger in Black Sea, 2347
Radioactivity,
calcium-45 and strontium-90, comparative absorption by young salmon, 2710
fission products and aquatic organisms, 2678
laboratory tests of deactivation of water, 2453
radioactive isotopes, 2691
strontium-90, penetration into fish from water, 2701
strontium uptake by fish, related to Ca water content, 2454
Radium pollution, importance of studies on, 2429
Rate-of-catch, relation to fork-length, 2310
Re-circulating, sea water system, 2677
Reclaimed, trout ponds in Massachusetts, 2755
Reclamation,
Indian and Abrams Creeks, 2767
Lake Hamilton, Arkansas, 2672
Recorder, electrical for dissolved oxygen, 2901
Recording, small concentrations of dissolved oxygen, 2926
Recruitment, year-class strength, index of, 2257
Red Tide,
control, copper sulfate, with, 2193
mystery of, 2594
plankton producing, vertical migration of, 2786
West Africa and Smyrna in, 2163
Reef,
fishes, food utilization by, 2248
standing crop of fish on shallow, 2326
References, aquatic vegetation control, 2475, 2476
Reflex, conditioned,
defensive, established in larvae, 2468
light with food, reversal and extinguishment, 2467
Regeneration,
fins and bony rays, 2137
taste barbel of catfish, effect of X-rays on, 2616
teleost scale, 2796
Regulations, commercial fisheries of Alaska, 2375
Rehabilitation,
stream, use of resistivity meter in, 2395
toxaphene use evaluated, 2200
Reproduction,
loach (Misgurnus anguillicaudatus), 2587
paddlefish (Polydon spatula), 2666
salmon, 2707
tilapia mixed with carp, 2140
Reproductive tissues, mullet, structure and development, 2738
Research,
Alaska fishery, progress report, 2852
laboratory facilities at U. S. station, 2379
Reservoir(s), (see also Water developments)
C^{14}, to study organic matter cycle in, 2845
California, seasonal changes in bluegill metabolism, 2539
Canyon Ferry, phytoplankton, 2776
Dnepr, mysis new to, 2749
electrofishing in, 2663
evaporation control with cetyl alcohol, 2148
fishes of, in Russia, 2413
forage introduced, Hemimysis anomala, 2409
hybrids, salt-water, for stocking, 2145
monolayers,
evaporation and seepage from water storages, 2544
influence of wind, wave and dust on, 2543
multiple-use in U. S., 2665
Oklahoma, paddlefish, growth and reproduction, 2666
oxygen resource in streams, affected by, 2441
salmonidae in, nutrition and growth of, 2923
strontium-90 concentrations permissible in, 2454
Tuloma River, condition of salmon stock, 2706
vegetation control, by nutria, 2480
Woods, fish management on, 2731
Resistance,
brook trout, to ulcer disease and furunculosis, 2753
crustaceans, freshwater, to action of sodium chromate, 2915
goldfish, to temperature under controlled photoperiods, 2743
midgefly, to electroplating wastes, 2865
Resistivity, reduced by salt addition, for electrofishing, 2289
Resources, fishery, can we manage Atlantic Coastal, 2864
Respiration,
bluegill, seasonal changes in metabolism, 2539
brain transection effects on, 2341
gill ventilation mechanism, 2575
oxygen consumption, O_2 and CO_2 concentration relations, 2372
rate, measurement, of phytoplankton, 2348
temperature influence on during development of sea trout, 2855
Response(s)
retinal, pink salmon during migration, 2741
squawfish, leading of within electrical field, 2769
Retina, structure of Pacific salmon, 2253

Retinal, responses, pink salmon during migration, 2741
Review,
development of oceanography, 2474
literature on water pollution, 2400
metabolism, intermediate, of current knowledge, 2396
Siluroidei of Chile, synonomy and distribution, 2496
Rimouski County, trout, brook growth and feeding, 2598
Ripeness, new technique for determining, 2295
"Rippling", habitat classification, based on biology and fisheries, 2514
Roach,
embryo development without water, 2521
temperature,
constant high, effects of, 2342
constant rate increase, effects of, 2344
Roccus saxatilis (see Bass, striped)
Rockbass, habitat and associated fauna, 2371
Rockfish (Scorpaenidae), review of California species, 2497
Rosin amine compounds, algae control use, 2427
Rotenone,
block-off net for sampling with, 2759
plant poison, importance for fisheries, 2920
reclamation of Lake Hamilton, Arkansas, 2672
Rough fish control, carp in Utah, 2147
Ruhr River, repeated destruction of fish in, 2906
Runner, blue, life history of, 2201
Ruthenium, radioactive, absorption by organisms, 2453
Rutilus rutilus (see Roach)

Sailfish, catch and sea condition relations in Kogoshima Bay, 2516
Sakholin region,
Euphausiidae population at, 2708
migration of humpback salmon, 2703
Salinity, (see also Oceanography, Chlorinity)
Atlantic Ocean water near Canada, 2364
brine water, tolerance of fish to, 2524
correlation between toxicity of ammonium sulfate to laver cell and, 2788
eggs, grey weakfish, hatching influenced by, 2249
growth influenced by, 2369
ionic regulation in brown trout, 2715, 2716
oceanographic observations, 2695
particulate matter distribution, relation to, 2346
San Francisco Bay, estuarine portion, 2528
Sargasso Sea, 2532
tolerance, of fresh-water fish, 2159
trout movement to salt water, no effect, 2271
Salmo
alpinus (see Char)
clarki (see Trout, cutthroat)
gairdnerii (see Trout, rainbow)
irideus (see Trout, rainbow)
salar (see Salmon, Atlantic)
trutta (see Trout, brown)
Salmon,
acclimatization of Bering Sea, 2714
Atlantic,
DDT spraying effects on, 2391
freshwater races, evolution of, 2570
landlocked, migration study, 2374
neurosecretory tract modifications, 2466
Shubenacadie River, distinctive population, 2266
young, territoriality and competition, 2290
Baltic, technique of catching, 2699
blueback (see also sockeye)
maturation of, 2671
chinook,
amino acid test diet for, 2851
biology of in Wenatchee River, 2772
diet, dry, 2675
eggs, effect of activation on water permeability of, 2586
fin clipping permanency, 2178
fishing mortality rates of, 2877
food habits of young, 2197
localized predation on marked fingerlings, 2878
mortality rate of troll caught, 2367
movement correlated with barometric pressure, 2349
plasma 17-hydroxycorticosteroids, changes in, 2751
rotary fish screens for diverting, 2670
spawn survival, streambed condition relation to, 2187
stomach contents of spawning, 2732
chum,
early development of, 2854
eggs of, response to free CO_2, 2251
environmental effects on survival, 2264
food habits of young, 2197
hemoglobin study of, 2306
hermaphroditic specimen, 2181
locomotor responses of fry, 2744
vibrio infections of, 2382
young,
lethal temperature tests, 2252
temperature affects swimming speed, 2274
coho, size differential due to food supply, 2422
comparative absorption of strontium-90 and calcium-45 by, 2710
distribution and migration, 2790
egg, membrane hardening enzyme, 2412
experimental fishing of to determine distribution, 2770
hatchery releases of, contribution to catch of, 2879
hemoglobins, multiple, in, 2307
humpback, migration of, 2703
Japanese fishery, review of, 2698
juveniles, in Stora and Lilla Lule Alv, 2590
king, vibrio infections of, 2382
kokanee, Spanish mainland for, 2582
lake fishing, in Russia, 2413
Okhotsk coast, increasing stocks of, 2709
oxygen consumption, method for study of, 2153

Salmon, cont.
Pacific,
distribution in north Pacific Ocean, 2316
growth influenced by salinity, 2369
intermediate host for Corynosoma, 2259
laboratory hatching and rearing of, 2177
origin and speciation, 2604
retina structure, 2253
role of dwarf males in artificial propagation, 2237
runs, artificial, established, 2349
tuberculosis in, 2362
pink,
scale characteristics, 2507
environmental effects on survival, 2264
food habits of young, 2197
hydroelectric development effects on, 2503
retinal responses of, during migration, 2741
three-year-old specimen, 2366
variations in weight of, 2654
vibrio infections of, 2382
red, North Pacific Ocean, age and race, 2578
reproduction, 2707
seaward migrants, modified fyke net for, 2388
Shannon River of, 2560
silver,
fecundity of, 2174
movement correlated with nighttime rainfall, 2349
stream dredging, effects of on, 2876
sockeye,
absolute changes in fat, protein, cholesterol, and water during migration, 2373
biochemical studies on during migration, 2882
biology of in Wenatchee River, 2772
early ocean survival relation to pink, 2257
fishery of Rivers Inlet, 2255
growth, survival, abundance, 2247
juvenile behavior, aggressiveness, 2300
migrating,
changes in muscle nitrogen, 2463
muscle constituents, non-protein nitrogenous, 2465
physical and plasma cholesterol measurements, 2464
"virus" disease of, 2404
spawning, population analysis, 2192
young,
lethal temperature tests, 2252
stock size and production relation, 2261
temperature affects swimming speed, 2274
studies of, 2625
survival of downstream migrant, 2874
troll-caught, fatigue and mortality in, 2883
tuloma, stock in Tuloma River, 2706
young, distribution of, in multi-basin system, 2258
Salmonidae,
ability to swim in water of reduced oxygen content, 2861
adipose fin in, 2613
egg of, mechanism of hardening, 2563
Salmonidae, cont.,
fishway for, passage through darkened, 2689
nutrition and growth of in reservoir, 2923
Salt resistivity reduced, for electro-fishing, 2289
Salvelinus
fontinalis (see Trout, brook)
namaycush (see Trout, lake)
Sampler,
automatic water for marine shore stations, 2844
core, portable, for lake deposits, 2281
Sampling,
fish populations, block-off net for, 2759
quantitative,
pushnet for, in shallow estuaries, 2284
young of the year fish for, 2203
representative, in stream studies, 2442
San Francisco Bay, invertebrates from estuarial portion, 2528
Sardinella gibbosa, food habits of, 2132
Sardine, Pacific, behavior and reactions to light and darkness, 2558
Sardinops
caerula (see Sardine, Pacific)
ocellata (see Pilchard, South African)
Sargasso Sea, the 18° water in, 2532
Saturation, percentage of oxygen in water, 2904
Sauger, movement of, in river, 2211
Sawu Sea, tuna fisheries and oceanography, 2558
Scale(s),
albacore, use in age determination, 2399
arrangement, of 98 Japanese fish, 2312
growth and formation, smelt, 2269
regeneration of teleost, 2796
ring formation, implications of, 2311
salmon, pink, characteristics of, 2507
School(ing),
social groupings in fishes, 2763
yellowfin tuna, deduced from distribution of catch, 2797
Scomberomorus
cavalla (see Mackerel, king)
maculatus (see Mackerel, Spanish)
regalis (see Mackerel, painted)
Scombroid fishes, Gulf of Mexico from, 2638
Scorpaenidae (see Rockfish)
Screen(s),
rotary in northeastern Oregon, 2670
size, importance in washing marine bottom samples, 2522
Sea, physical and chemical properties of, conference on, 2924
Seabass, review of, 2762
Sea-trout, influence of temperature on respiratory metabolism during development of, 2855
Sea water, bacterial populations in, 2536
Secretion, gas, inert, into swimbladder, 2221
Sediment(s),
cores, oxygen consumed in water over, 2780
correlation between plankton, benthos and, 2888
lakes, bacteria in and its place in lake classification, 2781
organic, erosion-littoral of Lake Balaton, 2794
Pyramid Lake, Nev., of, 2488

Seepage, water storages from, 2544
Seiche, South Bay, Ontario, 2777
Seine,
electric,
quantitative sampling for, 2203
small fish in lakes for, 2872
minnow, measurement of factors affecting catch in, 2600
Selectivity,
commercial nets in T. V. A. lakes, 2860
fishery, commercial, on sockeye salmon, 2255
size, of toxaphene concentrations, 2180
Senses, role of in feeding of moray eels, 2735
Seriola
dumerili added to list for Cedar Key, Fla., 2494
quinqueradiata (see Yellowtail)
Serranids, hermaphroditism and self-fertilization, 2296
Sevin, toxicity compared to DDT, 2492
Sex,
hermaphroditic chum salmon, 2181
ratio, Indian sand whiting, 2510
reversal,
artificially induced, functional, 2215
medaka in, of genotypic females, 2853
Sexual,
dimorphism, redside dace, 2750
maturation, Pacific salmon and rainbow trout, changes in plasma 17-hydroxycorticosteroids accompanying, 2751
Shad,
American,
migration pattern of, 2184
relation of harvest to spawning run size, 2185
southern range extension, 2894
tagging and recovery study, 2461
Shannon River, salmon of, 2560
Sheepscot River, ecology of estuary of, 2773
Shiner,
bigmouth, variation, intro-specific, 2345
common, ligula infested, 2472
redside,
distribution and movements, 2649
predator-prey interaction, 2650
Shocker, back-pack portable, described, 2199
Shocks, electrode, changes for safety and efficiency, 2386
"Shoot" carp, culture of modal group and growth of fry reared individually, 2629
Shrimp,
Apalachicola drainage of, 2534
pink, new microsporidan parasite from, 2869
pushnet for quantitative sampling of, 2284
Siberia, eastern, fish acclimatization in, 2842
Sight, visual perception in fish, 2631
Sillago sihama (see Whiting, Indian sand)
Siphon, constant-flow, for prophylactic treatment, 2389
Size, snapper racial differences, New Zealand, 2639
Skipjack,
morphometric comparison of from central and eastern tropical Pacific, 2728
postlarval form, 2603
Slime-controlling agents, toxicity of, 2157
Sludge deposits, oxygen balance, effects on, 2438
Smelt, age and growth of, 2269
Snails, acrolein for control of, 2634
Snapper, New Zealand, racial differences in size and growth, 2639
Soaps, toxicity to fish, 2916
Social groupings, fish in, 2763
Sociology, effects of quota control, 2286
Sodium
arsenite, toxicity to man, livestock, and fish, 2427
chlorate,
toxicity to fish, man and livestock, 2427
use in vegetation control, 2427
chromate, resistance of freshwater crustaceans to action of, 2915
Soil disinfectant, toxicity to Lebistes, 2165
Sol'a River, contamination and self-purification, 2618
Sole, sand, larval development of, 2875
Solubility, oxygen, in water, 2904
Solubility, product, $CaCO_3$ in ocean, 2841
Sound(s),
baits for fishing as, 2146
courtship, of male blenniid, 2127
production of underwater by Opsanus sp., 2737
underwater, relation to fish behavior,
dropping and showering, 2588
echoless wall of aquarium, 2545
Sounding,
bathymetry of Gibbs Hill area, 2531
recorder for use at sea, 2689
ultrasonic echo sounder, 2608
South Bay, seiche of, 2777
South Carolina, life history of the spot in, 2580
Spawn(ing),
albacore, in Pacific Ocean, 2398
artificial, use of precocious male salmon in, 2237
behavior of bluebreast darter, 2748
bream (Abramis) and embryonic development of, 2506
carp,
eggs discharged, relation of, to ovarian eggs at primary, 2602
water chemistry for, 2343
controlled, effects on fish culture, 2667
equipment to measure seepage through redd, 2262
fish, lower Welna River, 2798
Indian major carps, factors influencing, 2511
induced, with mammalian chorionic gonadotrophins, 2490
king salmon, stomach contents of, 2732
lamprey, river, 2605
loach, acceleration of by injection, 2567
pike, northern, behavior of, 2291
salmon, sockeye, escapement analyzed, 2192
Sardinella gibbosa, 2132

Spawn(ing), cont.,
scombroid fishes, 2638
trout, lake, 2195
warm water fishes, use of human chorionic gonadotrophin to, 2754
weakfish, grey, 2249
yellowtail,
East China Sea, 2308
Japanese waters, in, 2508, 2561
Speciation, marine animals, problems of, 2571
Sperm,
activating factor of herring egg, 2572
storage and transportation, rainbow trout and pike, 2713
viability life, effect on hybridization, 2123
Sphyraena barracuda (see Barracuda, great)
Spleen, plasma cells absent, 2358
Sport and commercial harvests compared, 2301
Sport fishing,
industry, value of, 2515
report of survey to evaluate need for specific fish toxicants, 2752
Spot, biology and life history, 2580
Spraying, aerial,
DDT of, effects on fish, 2391, 2392
fish, effects on, 2390
Spruce budworm, spraying, effects on fish, 2391
Squawfish, leading within an electric field, 2769
Squeteague (see Weakfish)
Standing crop, fish on Bermuda reef, 2326
Standpipe, groundwater, measures seepage through spawning gravel, 2262
Station, list of field investigations, Arctic Unit, 2881
Statistical basis for estimating plankton algae, 2456
Statistics,
comparing several rates or proportions, 2315
growth rate, analysis of, 2314
model, for comparing rates or proportions, 2315
mortality estimation bias, virtual populations, 2365
Stickleback
brook, biology of, 2929
egg, explosion of isolated cortical alveoli, 2579
Gasterosteus aculeatus, egg cleavage abnormalities, 2730
threespine,
life history, 2693
morphological development of, 2469
Stimuli,
olfactory, responses to schools of fish of, 2717
sound, movement of fish in response to, 2568
water temperature and response relation between for, 2593
Stizostedion
canadense (see Sauger)
vitreum (see Walleye, yellow)
Stocking,
fish planting tank, 2674
ratios, ponds, bass and bluegill, 2460
salmon,
catch, contributions to, by, 2879
kokanee, for Spanish mainland, 2582
Stocking, cont.,
survival, lake trout in Lake Huron, 2196
trout,
lake, fingerling vs. yearling, 2363
rainbow, in Paul Lake, 2664
Stocks,
flounder, yellowtail, decline of, 2697
salmon (salvelinus malma) measure of increasing, 2709
size of, 2581
Stomach, king salmon, contents of at spawning, 2732
Stora Lule Alv, biology of juvenile salmon of, 2590
Stream(s),
classification, pollution abatement program, 2434
fauna, effects of stream condenser discharge on, 2156
flow, maintenance, Wisconsin legislation and water rights, 2423
intermittent, minnows response to, 2210
mixing and diffusion of wastes in, 2440
power, condenser discharge effects, 2156
re-aeration theory for, 2437
sampling, pollution, cross-sectional method, 2220
studies, sampling and analytical methods in, 2442
vegetation, importance of, 2162
Strontium-90,
absorption by young salmon, 2710
concentrations permissible in open reservoirs, 2454
fish uptake relative to Ca content of water, 2454
penetration into fish, 2701
radioactive, absorption by organisms, 2453
uptake, of wild and lordotic guppies, 2222
Structure, reproductive tissues of mullet, 2738
Sturgeon,
breeding on Agrakhan Gulf, 2700
hybrids, for stocking reservoirs, 2145
roe, hatching and incubation, 2712
Sucker, white, swimbladder development of, 2337
Sulfide, mine wastes, river pollution by, 2821
Sulphate, blood, measured in migrating salmon, 2464
Sunfish, bluegill, Bothriocephalus sp. in, 2125
Supercooling, Arctic fish in, 2832
Supersonic wave, effect on fish behavior, 2583
Supply, water, limnology of Arctic lakes in relation to, 2911
Surface drift charts for eastern tropical Pacific Ocean, 2305
Survey,
fishery,
problems for and techniques for solution, 2829
sport, specific fish toxicants, need for, 2752
multiple-use reservoir practices, 2665
oceanographic, south Atlantic coast of U. S., 2288
technical fishery personnel of, 2661
vegetation, aquatic, Tyup Gulf and Lake Issyk-kul', 2421

Survey, cont.
Wenatchee River, Washington, water quality of, 2188
Survival, (see also Mortality)
failure of, slowly growing members of population, 2837
growth, non-logarithmetic, effect on, 2329
Indian carp, effects of vitamin B_{12}, cobalt nitrate, and ruminant stomach extract on, 2897
marking and tagging effects, 2381
quantitative comparison of, 2315
salmon
downstream migrants passing dam in open flume, 2874
importance of early ocean, 2256
several stocks compared, 2256
sockeye, young of, 2247
spawn, salmon, related to streambed conditions, 2247
time, acclimatization-lethal temperature relations, 2342, 2344
trout,
brown, of stocked, 2142
fingerlings, estimation by observation of, 2849
lake, 2363
yearling, in Lake Huron, 2196
Sweden, Salmo alpinus in running waters of, 2816
Swimbladder,
acoustic reflection of, 2240
development of, 2337
gas, inert, secreted into, 2221
hearing sensitivity related to, 2332
physical properties of,
cypriniformes in, 2718
fish, other than cypriniformes, 2721
isolated, cyprinidae in, 2720
Swimming layer,
seasonal variation of,
relation to vertical distribution of chlorinity, 2827
yellowfin tuna, big-eye tuna and black marlin, 2826
Swordfish,
broadbill, post larvae description, 2352
distribution and migration in northwestern Pacific, 2848
Symposium,
chemistry of the sea, 2217
marine productivity, 2208
Systematics, (see also Taxonomy)
barracuda, great, 2647

Tagging,(see Marking and Tagging)
herring, juveniles in Barkley Sound, 2652
recovery, herring, 2270
Tag returns,
catfish, channel, in river, 2209
sauger, in river, 2211
walleye, yellow, in river, 2211
Tags, retention and survival rates of various, 2381
Taius tumifrons, regeneration of scale of, 2796
Tank, fish-planting, 2674
Tapeworm, pseudophyllidean, in bluegill, 2125
Taxonomy,
Attheyella northumbrica, synonomy of, 2410
bream, 2 races compared, 2228
catfish, clariid, new genus and species, 2334
Coregonidae, by biochemical method, 2635
crayfish of California, 2361
immunological method for analysis, 2493
intro-specific variation in bigmouth shiner, 2345
lethal temperature as a tool in, 2656
Makaira, morphology of pectoral girdle, 2225
marlin,
blue and black, synonomies, 2360
striped, races of, 2226
new microsporidan parasite, 2869
nomenclature "Cuvier and Valenciennes" not correct, 2131
Notropis uranoscopus, 2304
(Oncorhynchus) origin and speciation, 2604
pilchard, South African, 2245
scale arrangement of 98 Japanese fish, 2312
Scomberomorus, comparative osteology of, 2359
Scorpaenidae of California, 2497
seabasses of genus Centropristes, 2762
Shenandoah River fish, problems of, 2202
swimbladder, relation of cypriniform ostariophysine, 2337
synonomy of Siluroidei of Chile, 2496
tetra, new, of Hyphessobrycon, 2204
Technique(s), (see also Methods)
artificial fertilization of trout ova, new, 2295
fishery survey, 2829
laboratory hatching and rearing of salmon, 2177
maintenance and transportation of aquatic animals, 2833
rescue, using oxygenated flow for attractant, 2179
ripeness determination, for trout, new, 2295
salmon, Baltic, catching, 2699
same-slack, for water quality study, 2484
Teleosts,
hematologic observations, 2358
tissue, ionic composition of, 2357
Temperature,
bottom fauna, influence of, 2129
carp spawning, no influence on, 2511
changes, effects of stream plant discharges, 2156
constant,
high, effects of, 2342
rate increase, effects of, 2344
copepods, distribution of, in relation to, 2637
daily fluctuation, fish movement relation to, 2128
data, Harbour of Castillion, relation of to fishing, 2839
experimental kidney infections, effects on, 2394
feeding rate influenced by, 2248
feeding rhythm, influence on, 2519
fishing gear catches affected by, 2368
hatching, grey weakfish eggs, influence of, 2249
lethal,
tool in taxonomy as, 2656

Temperature,
lethal, cont.
young salmon, of, 2252
limiting factor for winter growth, 2350
observations, east coast of U. S., 2695
pentachlorophenate toxicity affected by, 2331
perch growth, effects on, 2139
preferred, acclimation level influence on, 2275
rearing, influence on temperature tolerance, growth rate, and body form, 2815
recorder, for use at sea, 2689
relation between air and water of lakes, 2778
resistance, goldfish, 2743
respiratory metabolism of sea trout, influence of on, 2855
response to stimuli, relation between, 2593
Sargasso Sea in, 2532
structure, Bering and Aleutian waters, 2144
surface, sea-water, seasonal variations, 2234
swimming speeds affected by, 2274
thyroid activity, relation to, 2339
thyroid-pituitary relationship, effect on, 2585
-treated eggs or Gasterosteus aculeatus, abnormal development of, 2730
trout movement to salt water stimulated by, 2271
vertebrae,
fin ray formation and, effect of on, 2668
number of in fish, effect of on, 2541
water,
adaptability for albacores, 2825
upper layer in seas southwest of Kyushu and around Nanseishoto, 2725
Tench, respiration, effects of brain transections on, 2341
Tendipes plumonsus, insecticides to control, 2805
Tennessee, muskellunge in streams of, 2871
Ten-pounder, development and metamorphosis of, 2765
Terramycin, fin rot control in fishes, 2676
Territoriality, development and structure, salmon and trout juveniles, 2290
Territory, restricting movements of fish, 2525
Tetra, new, of genus Hyphessobrycon, 2204
Theory,
dualism, annual plankton cycles, 2292
mixing, longitudinal, of wastes in streams, 2440
re-aeration in streams, 2437
Therapeutic, agents for control of kidney disease in trout, 2866
Thermocline,
topography, horizontal currents and "ridging", 2121
visible, naturally occurring, 2356
Thermometer,
airborne radiation, for sea surface temperature, 2502
reversing, effect of pressure upon, 2533
Thiodan, toxicity-temperature relation, 2166
Thunderstorms, favorable influence on carp spawning, 2511
Thunnus thynnus (see Tuna, bluefin)
Thyroid,
activity, related to temperature in trout, 2339
Thyroid, cont.
albacore, histological study of, 2491
anatomical study of bluefin tuna, 2491
Fundulus heteroclites, function in, 2733
goldfish, function of, in, 2405
Japanese teleosts, 2566
-pituitary relationship, effect of temperature changes on, 2585
rainbow trout, physiology in, 2830
Tide(s),
currents, dominant flow, 2265
trout movements to salt water, no effect, 2271
Tilapia,
breeding behavior relation to ecological differences, 2336
carp, mixed culture, influence of fertilizer and feed, 2350
culture, mixed, with carp, 2140
galilaea, cultivation with carp, 2297
key to pond species, 2739
mono-sex culture of, 2354
nilotica, cultivation with carp, 2297
Tinca tinca (see Tench)
Tissue, ionic composition of, 2357
Titration, automatic potentiometric, for dissolved oxygen, 2688
Toadfish, production of sound by, 2737
Todos Santos Bay, range extension of American shad to, 2894
Tolerance,
catfish, channel, to PMA, 2170
euryhaline species to oil field brine, 2504
fresh-water fish to salt water, 2159
prediction of, to toxic pollution, 2272
relation of oxygen to chemical toxicity, 2445
salmon,
eggs to high CO_2 level, 2251
young, to below-freezing temperatures, 2252
Toothcarps, viviparous, pathological parthenogenesis in, 2223
Topography, geopotential agreement of drift bottles with, 2254
Toxaphene,
fish, bottom fauna, plankton, effects on, 2200
selective for size, 2180
toxicity of, used as rodenticide, 2168
toxicity-temperature relation, 2166
toxicity to fish, bottom fauna, and plankton, 2200
Toxicants, need of specific fish, 2752
Toxicity,
acaracides, to Lebistes, 2165
chemicals,
algae control, 2427
vegetation control, to fish, livestock, and man, 2427
chemical wastes, synergistic constituents at low pH, 2169
chlorine and chloramines, to rainbow trout, 2909
CMU, to fish, 2160
dinitrocarbazole to fish, 2686
Dipterex, to trout, 2158
disinfectants, fish and animals to, 2917
dyes, hydrological study, 2168

Toxicity, cont.
endrin, temperature relation, 2173
insecticides,
fish to, 2662
Lebistes to, 2165
temperature relation to, 2166
Tendipes plumonsus to, 2805
young carp to, 2799
narcotics, to fish, 2167
oxygen's effects on chemicals, 2445
parathion, to trout, 2158
pentachlorophenate, sodium, effects of various factors on, 2331
phenolic waste water, fish to, 2919
phosdrin, to trout, 2158
poisoned waters, 2685
radioactive isotopes, 2691
rodenticide, 2168
Sevin, compared to DDT, 2492
short-term, of 86 chemicals of refinery wastes, 2462
slime-controlling agents used in pulp industry, 2157
sodium chromate, resistance of freshwater crustaceans to, 2915
subsoil clays, of Oklahoma, 2462
synthetic detergents and soap, fish to, 2916
waste, explosives factory, 2168
weed killers to fish, 2679
Toxin formation, bacteria-free cultures of Prymnesium in, 2680
Transparency,
daylight penetration measurements, 2355
water, determination, 2574
Transplantation, gonad maturation normal of whitefish, 2408
Transporting,
fish,
equipment compared, 2353
lethal aspect of hyperactivity, 2273
mortality, early post-planting, factors evaluated, 2171
trout in sealed polyethylene bottles, 2176
living aquatic animals, techniques which facilitate, 2833
Trapping, use of oxygenation to rescue northern pike, 2179
Treatment, cost of for fish diseases, 2757
Trees, inundated, detection of by ultrasonic echo sounder, 2608
Trematodes,
digenetic,
fishes, of, 2564
marine fishes from Gulf of Panama and Bimini, 2734
Trichloraecetic acid,
toxicity to fish, man, and livestock, 2427
vegetation control, use in, 2427
Trilon B, hardness determination, 2425
Troll-caught, Pacific salmon, fatigue and mortality in, 2883
Trout,
brook,
egg membranes, X-ray diffraction of, 2323
Trout,
brook, cont.,
fecundity and growth, 2617
furunculosis treatment with nitrofuran, 2384
growth and feeding, 2598
habitat and associated fauna, 2371
movements between fresh and salt water, 2271
resistance to ulcer disease and furunculosis, 2753
therapeutic agents to control kidney disease, 2866
brown,
adverse effect of rainbow trout, 2513
embryo development without water, 2521
fecundity of, 2124
growth and feeding, 2591
growth and survival of stocked, 2142
ionic regulation in, 2715
osmotic and ionic regulation in, 2716
population in spawners in Vistula River, 2809
research, 9th annual report, 2898
thyroid gland activity, seasonal variation, 2339
trematode from urinary bladder of, 2243
variation in specific growth and relation between average and individual specific growth, 2847
young, territoriality and competition, 2290
char, occurrence in Sweden, 2816
culture, jar, of eggs of, 2383
cutthroat,
furunculosis treatment with nitrofuran, 2384
"homing" of, 2385
movements of, 2385
embryos, relation between yolk size and differentiation, 2742
fingerling survival estimation by observation, 2849
fishery condition, evaluation of, 2143
fish-planting tank for, 2674
hatchery, post-planting mortality factors evaluated, 2171
hemoglobins, multiple, in, 2307
kill due to lignite pit discharge, 2378
lake,
management of, 2363
marking and tagging effects, 2381
spawning behavior, 2195
survival of yearling stocked, Lake Huron, 2196
movement to salt water, no effect, 2271
nutrition and physiology, role of minerals in, 2870
ponds, reclaimed in Massachusetts, 2755
rainbow,
blood,
chromium-induced changes in, 2918
volume of, 2333
yearlings, changes in, during and following severe muscular activity, 2880
brown trout, effect of on, 2513
chlorine and chloramines, toxicity of to, 2909

Trout,
rainbow, cont.
diet, 2653
diseases, 2704
distribution and movements in Paul Lake, 2649
ecological and ethological characteristics of, 2513
egg(s),
amino content of protein changes in, 2802
interference of broken and effect of egg washing method, 2823
erythrocyte count and size, 2333
fecundity of, 2124
hematocrit value for, 2333
hemoglobin value for, 2333
histology and histopathology, 2609
ichthyosporidium, liver and kidney lesions, 2471
induced inflamation and treatment of digestive organs, 2740
organ, weights of, 2333
pH of eggs, milt and coelomic fluid, 2824
plasma 17-hydroxycorticosteroids, changes in accompanying sexual maturation and spawning, 2751
plasma volume of, 2333
redside shiner, relationship with, 2630
sperm, storage and transportation, 2713
thyroid physiology in, 2830
trout hatcheries and of the future, 2859
vibrio disease, 2623
vibrio infections of, 2382
yield in Paul Lake, 2664
steelhead, tuberculosis in, 2362
transportation in plastic bottles, 2176
weight-fecundity relation, 2124
Tuberculosis,
salmon, Pacific, 2362
trout, steelhead, 2362
Tuloma River, salmon, condition of stock, 2706
Tuna,
bigeye, rate-of-catch and fork length relations, 2310
bluefin, thyroid, anatomical and histological study, 2491
fisheries in Sawu Sea, 2558
Thunnus thynnus, pineal organ of, 2806
yellowfin,
bigeye and,
relation between seasonal variation in swimming layer and vertical distribution of chlorinity, 2827
seasonal variation of swimming layer of, 2826
morphometric comparisons among,
eastern tropical Pacific from, 2723
equatorial Pacific from 2807
Indian Ocean from, 2857
western Great Sundra Islands and Pacific from, 2808
school deduced from catch distribution, 2797
skipjack and, relations between length and weight of from eastern tropical Pacific, 2722
Turbidity,
phosphate phosphorus, correlation to, 2328
trout movement to salt water, no effect, 2271
Turbine, aeration to increase purification capacity of stream, 2905
T. V. A., selectivity and effectiveness of commercial nets in lakes of, 2860
Twine, effects of tar acids on fishing, 2727

Upper Kisatchie drainage, survey of fishes, 2565
Upwelling aspects of Gulf of Panama, 2122
Uranium,
pollution, effects on stream, 2429
toxicity of, 2168
Urea level, blood, measured in migrating salmon, 2464

Vapan, toxicity to Lebistes, 2165
Vegetation,
aquatic,
CMU as control for, 2160
control,
references on, 2475, 2476
reservoirs in, by nutria, 2480
survey of methods, 2427
water hyacinth, of, 2207
importance to stream fishes, 2162
survey of Tyup Gulf and Lake Issyk-Kul', 2421
influence on polluted stream conditions, 2447
Vertebrae,
age determination based on centra, 2309, 2399
influence of temperature on fish, 2541
salmon, chinook, 2668
Vertebral, ligament in dorsal aorta of fishes, 2747
Vibrio infections, of Pacific salmon and rainbow trout, 2382
Virginia, length, weight and age composition of menhaden catch in, 2537
Virus disease, etiology of sockeye salmon, 2404
Vistula River, population of trout spawners in, 2809

Walleye, yellow,
harvest, population, mortality, etc., 2517
life history, ecology, management, 2377
movement of, in river, 2211
Washington, Dept. of Fisheries Annual Report, 1957, 2785
Waste(s),
disposal, deep sea, study of one method, 2432
electroplating, a midgefly resistant to, 2865
sulfide mine, river pollution by, 2821
Water,
content, absolute changes during spawning migration, 2372
developments,
fish passage, latest in Netherlands, 2172
hydroelectric,
salmon, effects on, 2503
salmon in Russia, effect on, 2413
thermal releases, effect on, 2427
legislation and water rights in Wisconsin, 2423

Water,
developments, cont.
power plant heated discharge, effects on, stream, 2156
reservoirs, effects on oxygen in streams, 2441
tuberculosis increase, indirect effect on, 2362
fluctuation, trout movement to salt water stimulated by, 2271
heavy, irradiation of fish in, more damaging than tap water, 2457
hyacinth, chemical control of, 2207
quality of Wenatchee River, Washington, 2188
resources, western U. S., today and tomorrow's, 2232
rights, Wisconsin, stream flow maintenance, 2423
Weakfish, grey, pelagic phase, development and ecology, 2249
Weeds, use of chemicals to control, 2908
Weight,
Columbia pink salmon, variation in annual average of, 2654
yellowfin tuna and skipjack tuna, relationships between length and, 2722
Welna River, spawning of fish in lower stretch of, 2798
Wenatchee River, chinook and blueback salmon and steelhead, biology of in, 2772
West Okoboji Lake, bluegill in, 2599
Whitefish,
lake, age and growth, 2368
radio isotopes in, 2921
Whitefish, cont.
transplanted, normal gonad maturation of, 2408
Whiting, Indian sand, biology of, 2510
Wind, influence on surface circulation, 2183
Wisconsin, pond culture of muskellunge in, 2624

Xiphias gladius (see Swordfish, broadbill)
X-ray, diffraction of egg membranes, 2323

Year-classes, salmon of the Shannon River, 2560
Yellowtail,
age and growth, Japan, 2309
feeding habits of, 2313
hemoglobins, multiple, in, 2307
maturity,
spawning and, of, 2561
used as index to spawning, 2508
migration of, in East China Sea, 2308
spawning,
East China Sea, in, 2308
season and area, Japanese waters, 2508
Yield,
fertilization effects on, 2135
maximum sustained, numerical models used in study, 2260
sustained, thru regulation of optimum number spawning, 2261
Yolk, size, relationship between and differentiation in trout embryos, 2742

Zinc chloride, toxicity, relation to oxygen, 2445
Zoogeography, significance of River Sone fish fauna, 2126

****

ABSTRACTORS OTHER THAN AUTHORS AND STAFF

Biological Abstracts
Kelshaw Bonham
C. C. Davis
R. P. Elliott
D. V. Ellis
C. Ferrel
M. L. Goodnight
G. Gunter
P. Korringa
R. Margalef
Medical Documentation Service
D. B. Saxena
R. Tanaka
Water Pollution Abstracts

****

The following publications have been screened for volume 4. Abstracts not covered by this list are of irregularly published papers, are contributions of cooperating abstractors, or are of separates from publications not regularly received by the Department of the Interior Library. The first number indicates volume, and numbers within the parentheses indicate issues.

American Midland Naturalist, The
60(1, 2) 1958
61(1, 2) 1959
62(1) 1959

American Naturalist, The
92(866, 867) 1958
93(868, 869, 870) 1959

American Scientist
46(4) 1958
47(1, 2) 1959

Annals and Magazine of Natural History
1(9, 11) 1958

Annals of the New York Academy of Sciences
1958, 1959

Australian Journal of Applied Science
9(4) 1958
10(1) 1959

Australian Journal of Biological Sciences
11(4) 1958
12(1, 2, 3) 1959

Australian Journal of Marine and Freshwater Research
9(2, 3, 4) 1958
10(1) 1959

Australian Journal of Zoology
6(2, 3) 1958
7(1) 1959

Bamidgeh
10(1-4) 1958, 1959

Biochemical Journal, The
70(2-4) 1958
71(1-4) 1959
72(1-3) 1959

Biological Abstracts
32(10-12) 1958
33(1-12) 1959

Biological Bulletin, The
115(2, 3) 1958
116(1-3) 1959
117(1) 1959

Biological Reviews
34(1, 2) 1959

Biometrics
14(4) 1958
15(1-3) 1959

Bulletin of the American Museum of Natural History
116(3) 1959
117(1-6) 1959

Bulletin of the Faculty of Fisheries, Hokkaido University
9(2-4) 1958, 1959

Bulletin of the Fisheries Research Board of Canada
120, 1959

Bulletin of the Florida State Museum
3(4, 5) 1958
4(1, 11) 1959

Bulletin of the Illinois Natural History Survey
27(3) 1959

Bulletin of the Inter-American Tropical Tuna Commission
III(2-8) 1959

Bulletin of the Japanese Society of Scientific Fisheries
24(4-9) 1958, 1959

Bulletin of Marine Science of the Gulf and Carribbean
8(2-4) 1958
9(1, 2) 1959

Bulletin of the Southern California Academy of Sciences
57(3) 1958
58(1, 2) 1959

California Fish and Game
44(4) 1958
45(1-3) 1959

Canadian Field-Naturalist, The
72(4) 1958
73(1-3) 1959

Canadian Fish Culturist, The
(23, 24) 1959, 1960

Canadian Journal of Zoology
36(5, 6) 1958
37(1-4) 1959

Chemical Reviews
58(6) 1958

Contributions, Fish Commission of Oregon
(25) 1958

Contributions, Seto Marine Biological Laboratory
1958

Copeia
(4) 1958
(1, 2) 1959

Deep-Sea Research
5(2-4) 1958, 1959

Dissertation Abstracts
19(4-11) 1958, 1959

Doklady Akademia Nauk SSSR
115(1-6) 1957
116(1-6) 1957
117(1-5) 1957

Ecological Monographs
28(1-4) 1958
29(1-3) 1959

Ecology
39(4) 1958
40(1, 2) 1959

Fisheries Research Papers, Washington Dept. of Fisheries
2(2) 1959

Fishery Bulletin
58(141-155) 1958, 1959

Fishery Investigations - Series II, Ministry of Ag. and Fisheries
22(5) 1958

Fishery Leaflet
1959

Great Basin Naturalist
18(2-4) 1959
19(1) 1959

Indian Journal of Fisheries
V(2) 1958
VI(1) 1959
Journal of Animal Ecology
27(1, 2) 1958
Journal of the Bombay Natural History Society
55(3) 1958
56(1) 1959
Journal of Ecology
46(3) 1958
47(1) 1959
Journal of the Elisha Mitchell Scientific Society
75(1) 1959
Journal of Experimental Biology
35(4) 1958
36(1, 2) 1959
Journal of Experimental Zoology
136(2, 3) 1957
137(1-3) 1958
138(1-3) 1958
139(1-3) 1958
Journal of the Fisheries Research Board of Canada,
15(6) 1958
16(1-4)
Journal of the Marine Biological Association of the United Kingdom
38(1, 2) 1959
Journal of Parasitology
45(1-4) 1959
Journal of Soil and Water Conservation
14(1, 3) 1959
Journal of the Tennessee Academy of Science
33(4) 1958
34(1-3) 1959
Journal of the Tokyo University of Fisheries
44(1, 2) 1958
Journal of the Washington (D. C.) Academy of Sciences
48(9-12) 1958
49(1-5) 1959
Journal of Wildlife Management
22(4) 1958
23(1, 2) 1959
Journal of Zoological Society of India
9(1, 2) 1957
10(1, 2) 1958
Limnology and Oceanography
3(4) 1958
4(1-3) 1959
Linnean Society of London, Journal of
43(294) 1958
44(295, 296) 1958, 1959
Memoirs of the Faculty of Fisheries
7 1959
Memorie Dell 'Istituto Italiano Di Idrobiologia
9 1956
Nature
4640-4682, 4688) 1958, 1959
Nauka I Zhizn'
(11, 12) 1958
(1, 3) 1959
New York Fish and Game Journal
(6(1) 1959
Occasional Papers of the Museum of Zoology, University of Michigan
(596, 598-608) 1958, 1959
Pacific Science
12(4) 1958
13(1, 2) 1959
Papers from the Michigan Academy of Science, Arts and Letters
44 1959
Parasitology
48(3, 4) 1958
49(5) 1959
Physiological Zoology
31(1-4) 1958
32(1, 2) 1959
Priroda
(2) 1959
Proceedings of the California Academy of Sciences
29(10-12) 1959
Proceedings of Japan Academy
34(10) 1958
35(1-5) 1959
Proceedings of the National Academy of Sciences of the U. S.
44(1-12) 1958
45(1-7) 1959
Proceedings of the National Institute of Sciences of India
25(1-A, 1-B, 2-B) 1959
Proceedings of the Nova Scotian Institute of Science
24(3) 1956-1957
Proceedings of the Southeastern Association of Game and Fish Commissioners
12th Ann.. 1958
Proceedings of the Zoological Society of London
132(1-4) 1959
Progressive Fish Culturist
21(1-3) 1959
Progress Reports of the Atlantic Coast Stations
71 1958
Progress Reports of the Pacific Coast Stations
112 1958
Quarterly Journal of Florida Academy of Science
21(1) 1958
Quarterly Review of Biology
33(1, 2, 4) 1958
34(1, 2) 1959
Resource Study Report, Chesapeake Bilogical Laboratory
(10) 1958
Science
128(3327-3339) 1958
129(3340-3365) 1959
130(3366-3377) 1959
Scientific American
199(5, 6) 1958
200(1-5) 1959
Special Scientific Reports - Fisheries
1958, 1959
Systematic Zoology
7(1, 2) 1958
Technical Bulletin of the Montana Fish and Game Commission
(2) 1958
Transactions of the American Fisheries Society

88, 1959
Transactions of the New York Academy of Sciences
21(1-3, 5-8) 1958, 1959
Tulane Studies in Zoology
6(3, 4) 1958
7(103) 1959
University of Kansas Publications
10(7) 1959
11(3, 5-7) 1959
12(1, 2) 1959
Wasmann Journal of Biology, The
15(1, 2) 1957
16(1) 1958
Water Pollution Abstracts
31 (10-12) 1958
32(1-9) 1959
Zoologica-Scientific Contribution of the N. Y. Zoological Society
44(2) 1959

****

GPO 904407

FISH
RESTORATION